

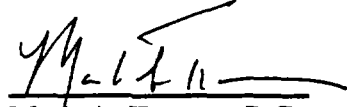


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**QUALITY ASSURANCE PROJECT PLAN (QAPP)
REMEDIAL DESIGN/REMEDIAL ACTION
MONITORING AND ADDITIONAL STUDIES
AT THE MARION (BRAGG) LANDFILL SITE
MARION, INDIANA
May 1990**

US EPA Quality
Assurance Officer

US EPA Project
Manager



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Date Approved

31 May 1990

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Date Approved

31 May 1990 .

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SECTION 1

PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) was prepared by Environmental Resources Management (ERM) for the Monitoring and Additional Studies to be conducted by Beak Consultants Limited in conjunction with the proposed remedy at the Marion (Bragg) Landfill in Marion, Indiana. This document is part of the PRP-Lead Remedial Design/Remedial Action (RD/RA). A detailed description of previous investigations are provided in the Remedial Investigation Report (Camp, Dresser and McKee, August 1987) and Feasibility Study Report (Camp, Dresser and McKee, August 1987) conducted for the US EPA-Region V. A detailed description of monitoring and additional studies to be conducted at the Marion (Bragg) Landfill is provided in the Remedial Action Plan (RAP ERM; 25 January 1989). A discussion of the site and site history is presented below and has been summarized from the Record of Decision (ROD) and Consent Decree (CD) issued by the US EPA and Indiana Department of Environmental Management (IDEM). The CD should be considered the binding document for the RD/RA. The ROD and CD should be referenced for additional information on the site description, site history and target compounds. Due to the size of the ROD and CD they have not been included as attachments to this QAPP. A description of the Monitoring and Additional Studies also follows.

It should be noted that if necessary the fish bioaccumulation study and the biological survey discussed in the RAP will be provided in a separate addendum to this QAPP.

1.2 Site Description

The Marion (Bragg) Landfill site consists of a 72-acre parcel of land located on the southeast edge of Marion, Grant County, Indiana (Figures 1-1 and 1-2). Approximately 45 of the site's 72 acres were used

Figure 1-1
Site Location
Marion (Bragg) Landfill

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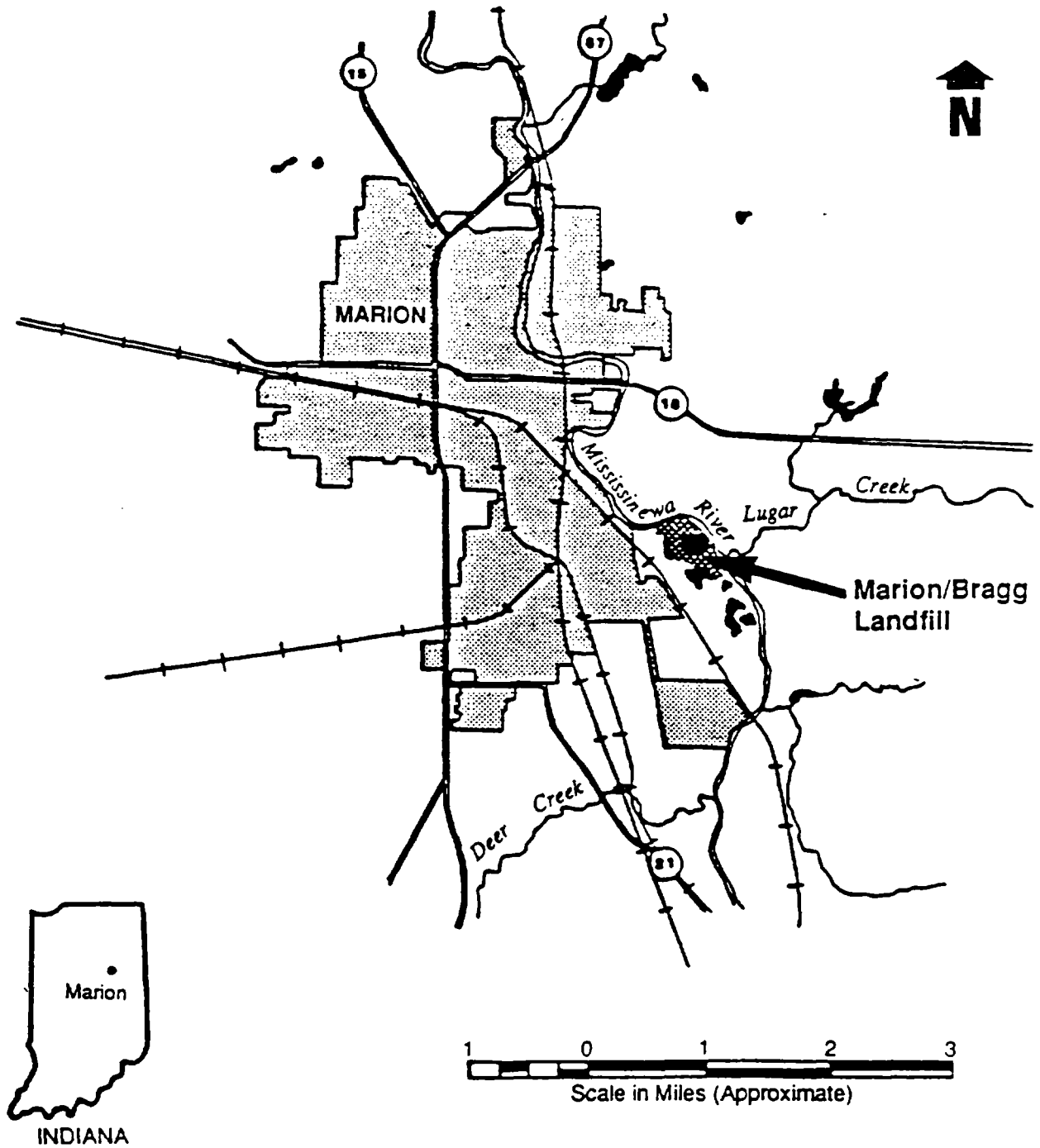
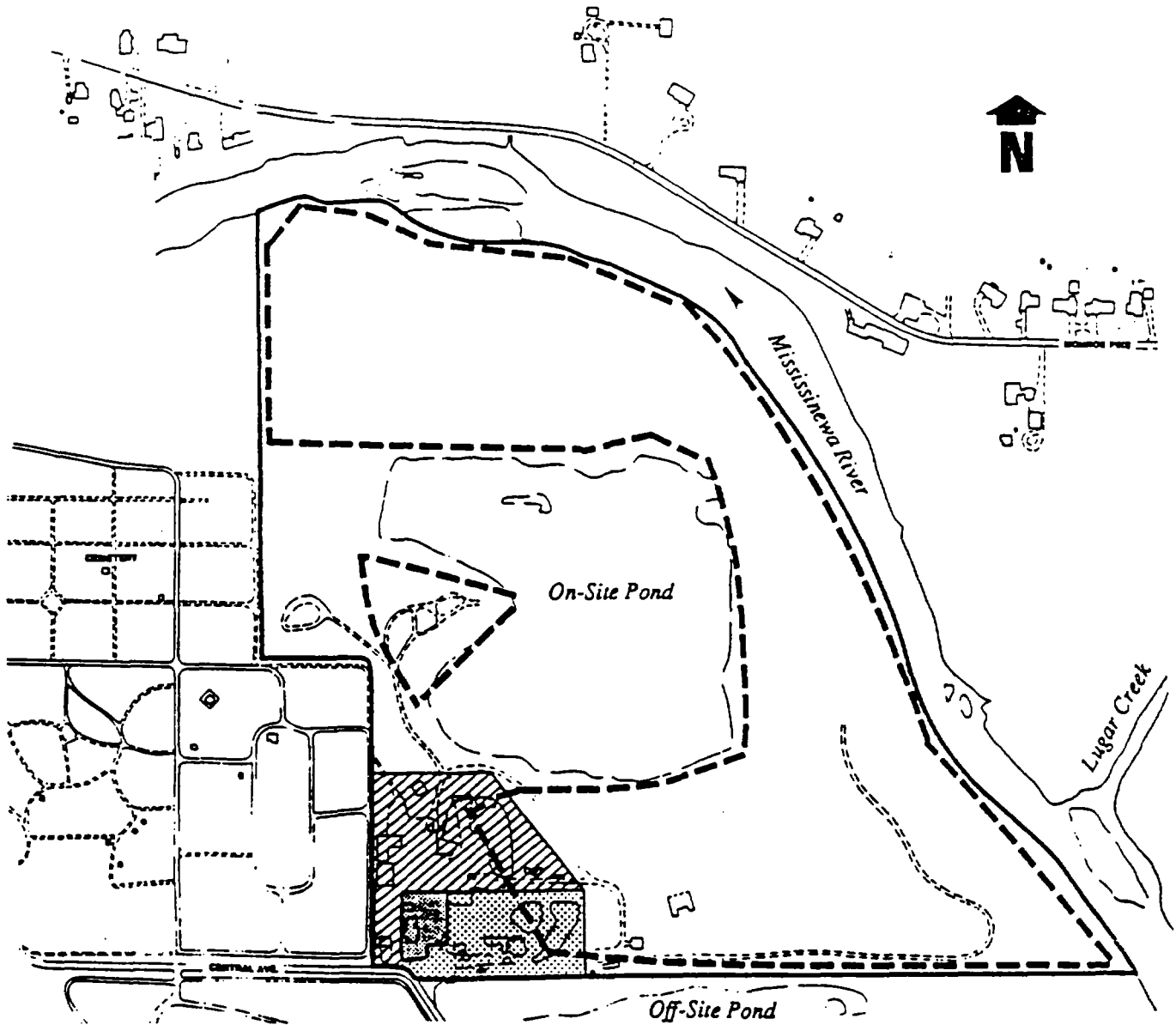


Figure 1-2
Site Map
Marion (Bragg) Landfill

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LEGEND

- Site Boundary
- /// Marion Paving Co., Inc.
- ▒ Dobson Construction Co., Inc.
- Private Residence
- - Landfill Area

0 250 500
Scale in Feet

Source: U.S. EPA 1987.

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for landfilling purposes prior to closing in 1975. The Mississinewa River borders the site to the east and north, a cemetery borders it to the west, and an abandoned gravel pond, which is presently used for commercial recreation purposes under the name of East Side Cove, borders it to the south. A large pond of approximately 15 acres lies near the center of the site. A residence and two businesses are located along the southwest corner of the site. The two businesses are Marion Paving Company and Dobson Construction Company; both are asphalt plants.

The landfill is heavily vegetated and does not presently appear to have any erosion problems. Vegetation covering the landfill consists of tall grasses and trees up to 6 inches in diameter.

1.3 Hydrogeology

As presented in the United States Environmental Protection Agency (EPA) and Indiana Department of Environmental Management (IDEM) Remedial Investigation Report (RI), three stratigraphic units underlie the Marion (Bragg) Landfill:

- o sand and gravel outwash ranging in thickness from 6 to 64 feet
- o Glacial till ranging in thickness from 54 to 63 feet
- o Limestone bedrock at a depth ranging from 89 to 125 feet below the ground surface

The sand and gravel and limestone are identified as the upper and lower aquifers, respectively. The glacial till separates the two aquifers, while serving as a confining layer for the lower aquifer. Both aquifers provide a potable water source in the vicinity of the Marion (Bragg) Landfill site. The upper aquifer is unconfined and ranges from 18 to 42 feet in thickness. The hydraulic gradient in the upper aquifer is towards the Mississinewa River, which the EPA and IDEM determined is acting as a hydraulic barrier causing ground water from beneath the site to discharge to river, thus preventing ground water flow beyond the river. Based on estimated flow velocities, the EPA reports that this upper aquifer purges itself every 2.2 years, or the site has completely purged approximately 7 times in the last 15 years.

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Glacial till separates the upper aquifer from the limestone which acts as the lower confined aquifer. The potentiometric surface of the confined aquifer is artesian and has been measured approximately 15 feet higher than the ground water table surface of the upper aquifer. The EPA and IDEM studies showed that the lower aquifer flows to the northeast.

1.4 Site History

The Marion (Bragg) Landfill Site originally was a sand and gravel quarry that operated from 1935 to 1961. The landfill is believed to have begun operations in 1957 as a municipal landfill. From 1957 to 1975 the landfill was operated by Mr. Delmar Bragg primarily for the disposal of municipal wastes. Periodic inspections by the Indiana State Board of Health (ISBH) indicated that the landfill was also accepting industrial wastes as well. ISBH records from 1973 indicate that wastes from Central Waste, Incorporated (a division of Waste Management, Inc.) were being worked into the landfill.

In 1975 the landfill ceased operations. Waste Reduction Systems (a division of Decatur Salvage, Inc.) began operating a transfer station on the premises in order to transfer solid wastes to an approved landfill. The transfer station closed in an acceptable manner (as determined by the ISBH) in 1977.

The Marion (Bragg) site was added to the US EPA National Priorities List (NPL) in December 1982. In May 1985 the EPA began a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS was completed by the EPA in August 1987. As of June 1988 the Marion (Bragg) site ranks 529th on the NPL.

1.5 Present Site Conditions

The following section is taken from the Record of Decision (ROD) issued by the EPA and IDEM on 30 September 1987.

"The final cover applied to the landfill is a very permeable silty sand material which varies in thickness from 3 to 24 inches. There are numerous areas where debris, including drum carcuses,

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protrude from the fill. The surface is vegetated in most areas and four to five inch diameter trees are also predominant surface features.

The on-site pond was at one time stocked for recreational fishing, but is no longer used as such. Teenage children have been seen fishing occasionally from the on-site pond, otherwise the site is not typically used. At the southwest edge of the landfill is an intake pipe and effluent ditch from the Marion Paving Company. Marion Paving has an expired permit issued for "private use water." The permit allows water withdraw/and discharge to the on-site pond for the gravel washing operation.

Another asphalt company, Dobson Paving Company and a private residential home are also located within the property boundary. All three have shallow wells which are in the upgradient, uncontaminated portion of the aquifer.

1.6 Previous Investigations and Target Compounds

As mentioned earlier, a detailed description of the previous investigations is provided in the Remedial Investigation Report (Camp, Dresser, and McKee, August 1987) and Feasibility Study Report (Camp, Dresser, and McKee, August 1987) conducted for the US EPA-Region V. The target compounds for the monitoring to be conducted in conjunction with the Remedial Design/Remedial Action at the Marion (Bragg) Landfill will be the Target Compound List (TCL) of organic constituents minus the pesticide/PCB organic fraction, the Target Analyte List (TAL) of inorganic constituents, and the IDEM indicator parameter list. Tentatively identified compounds (TICs) will be included in the organic TCL fractions, but will not be evaluated as part of the monitoring program. The TCL/TAL and IDEM lists and quantitation limits are presented in Table 7-2 of this QAPP. Sediment sample analysis will include grain size and total organic carbon (TOC).

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1.7 Selected Remedial Action

The remedial action consists of the following major components:

- o Regrade and cap the site;
- o Provide and maintain flood protection measures;
- o Construct and maintain a fence around the site;
- o Abandon the existing private-use drinking wells which currently exist at the site; and
- o Monitor ground water and conduct additional studies to complete the remaining ground water and on-site pond operable units.

The RAP (ERM-25 January 1989) presents the remedial actions to be taken proposed to achieve the recommended remedial alternative developed by US EPA and IDEM for the site.

1.8 Monitoring Objectives, Intended Data Usages and Data Quality Objectives

1.8.1 Ground Water

1.8.1.1 Specific Objectives

The specific objective of ground water monitoring is to monitor the effectiveness of the interim remedy. The ground water data gathered before and after installation of the cap will be evaluated to show the effectiveness of this remedy. Ground water monitoring performed before and after implementation of the remedy should demonstrate the effects of reduced infiltration on the shallow ground water table and water quality.

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1.8.1.2 Intended Data Usages

The results of the sampling of ground water wells will provide an average concentration of site-related contaminants in ground water discharging from the site. These concentrations will be used for comparison to applicable federal and Indiana State water quality standards, where available. If such standards are not available, a risk-based standard will be calculated, based on reasonable scenarios for river use (ingestion of fish, using local catch data and results of the bioaccumulation studies, and partial body contact during recreation). If current levels of site-related compounds in ground water meet these standards, no further action will be necessary; dilution as it occurs may be considered as an additional "safety factor." If current levels of site-related compounds in ground water do not meet surface water quality standards, a biological survey of the river will be conducted. A decision tree for future studies is presented in the RAP, Section 5 to determine whether the biological survey is necessary. The field pH, conductivity, dissolved oxygen and temperature measurements will be used to monitor general ground water quality.

1.8.1.3 Data Quality Objectives

To meet the intended data usages and the ARAR's referred to in Appendix 3 of the ROD, the data quality level for TCL/TAL analyses will be Level IV, Level III for all other laboratory analyses, and Level II for field analyses. The analysis levels are described below:

- o Level IV - CLP Routine Analytical Services (RAS). This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data.

- o Level III - Laboratory analysis using methods other than the CLP RAS. This level is used primarily in support of engineering studies using standard US EPA approved procedures. Some procedures may be equivalent to CLP RAS without the CLP requirements for documentation and QA/QC.

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- o Level II - Field analysis. This level is characterized by the use of portable analytical instruments which can be used on-site or in mobile laboratories stationed near a site (close-support labs). Depending upon the types of contaminants, sample matrix and personnel skill, qualitative and quantitative data can be obtained.

1.8.2 Surface Water

1.8.2.1 Specific Objectives

The specific objective of the surface water sampling and analysis program is to monitor the effectiveness of the remedy and determine whether surface waters are being impacted by the landfill.

1.8.2.2 Intended Data Usages

The surface water concentrations obtained will be used for comparison to applicable federal and Indiana State water quality standards, where available. If such standards are not available, a risk-based standard will be calculated, based on reasonable scenarios for river use (ingestion of fish, using local catch data and results of bioaccumulation studies, and partial body contact during recreation). If current levels of site-related compounds in surface water meet these standards, no further action will be necessary. If current levels of site-related compounds in surface water do not meet standards, a biological survey of the river will be conducted.

The field pH, conductivity, dissolved oxygen, and temperature measurements will be used to monitor general surface water quality.

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1.8.2.3 Data Quality Objectives

To meet the indented data usages and the ARAR's referred to in Appendix 3 of the ROD, the data quality level for TCL/TAL analyses will be Level IV, Level III for all other laboratory analyses, and Level II for field analyses.

1.8.3 River Sediment

1.8.3.1 Specific Objective

The specific objective of the river sediment sampling program is to provide an indication of the distribution of contaminants, if any, in the sediment as compared to other stations.

1.8.3.2 Intended Data Usages

The sediment concentrations obtained will be used for comparison to applicable federal and Indiana State water quality standards, where available. If such standards are not available, a risk-based standard will be calculated, based on reasonable scenario for river use (ingestion of fish, using local catch data, and results of the bioaccumulation studies, and partial body contact during recreation). If current levels of site-related compounds in sediment meet these standards, no further action will be necessary. If current levels of site-related compounds in sediment do not meet standards, a biological survey of the river will be conducted.

The chemical characteristics of the sediment will also be used in the selection of target compounds to be analyzed in possible fish bioaccumulation studies, if necessary. A decision tree is presented in the RAP, Section 4.5 to determine whether the bioaccumulation study is necessary. In addition to the specified chemical analyses, grain size and TOC will be determined to indicate surface area and organic carbon content.

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1.8.3.3 Data Quality Objectives

To meet the intended data usages and the ARAR's referred to in Appendix 3 of the ROD, the data quality level for TCL/TAL analysis will be Level IV and Level III for all other laboratory analyses.

1.9 Sample Network and Rationale

1.9.1 Ground Water Sampling

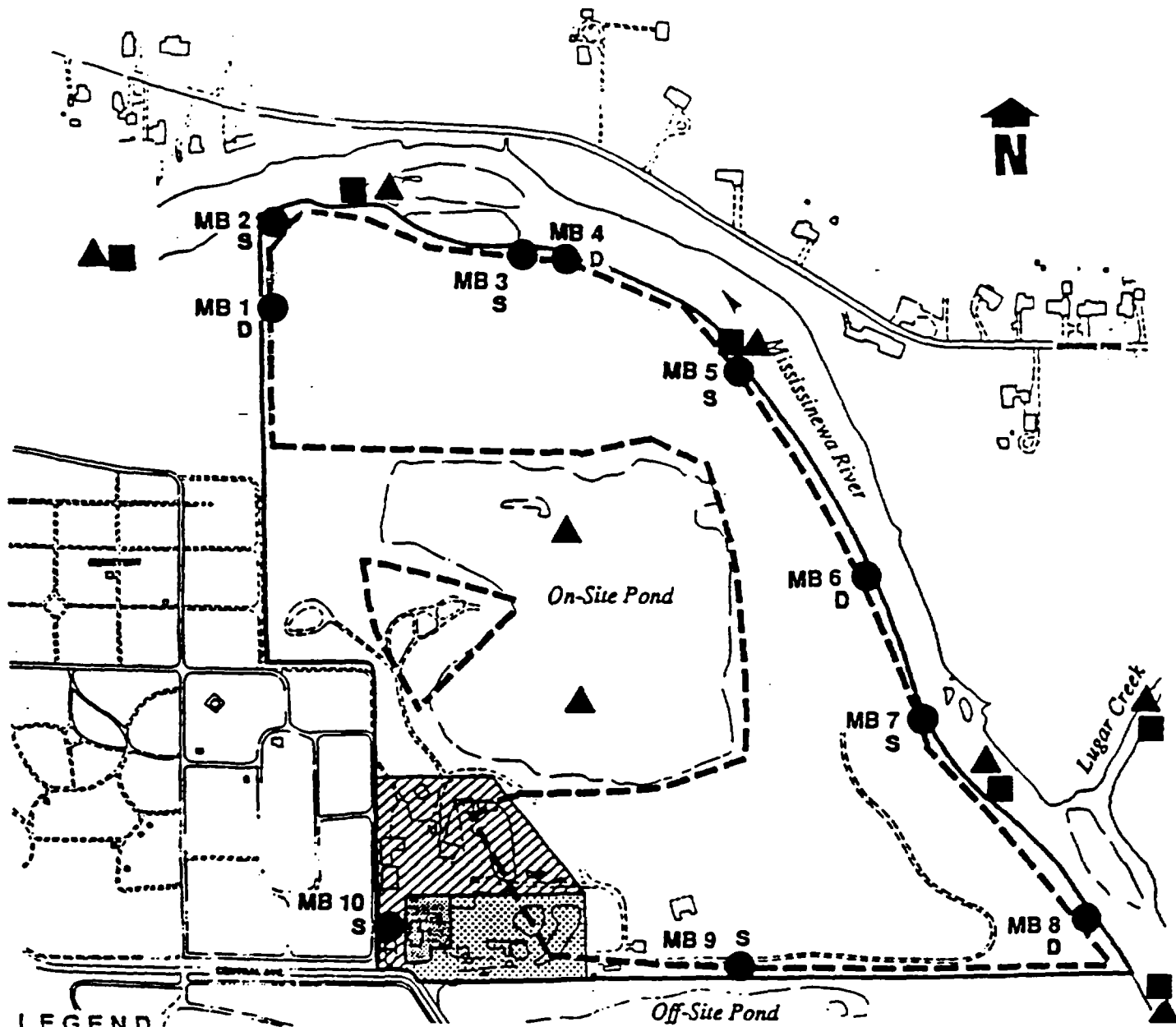
The proposed locations of ten new monitoring wells (Figure 1-3) were selected with consideration of the following factors:

- o The wells should not be installed through buried waste.
- o The geology of the site can be assumed to be relatively simple, with a relatively homogeneous upper aquifer.
- o The upper aquifer discharges into the Mississinewa River.

Eight of the ten proposed shallow monitoring wells will be installed at locations evenly distributed on the landfill property boundary adjacent to the river which are downgradient from areas of waste deposition, and upgradient from the Mississinewa River. These wells, close to the river and outside of the landfill wastes, will provide a more accurate indication of the quality of ground water which is discharging to the river. In addition, these wells will help to monitor the potential influence of surface water quality on the quality of ground water beneath the site, which is a common occurrence in river flood plains during periods of high water and gradient reversal.

Figure 1-3 Proposed Sampling Locations Marion (Bragg) Landfill

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LEGEND

- Site Boundary
- /// Marion Paving Co., Inc.
- ▨ Dobson Construction Co., Inc.
- Private Residence
- - - Landfill Area
- ▲ Proposed Surface Water Sampling Locations
- Proposed Ground Water Sampling Location
S - Shallow Zone of Upper Aquifer
D - Deeper Zone of Upper Aquifer
- Proposed Sediment Sampling Location

0 250 500
Scale in Feet

Source: U.S. EPA 1987.

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The two remaining wells will be installed upgradient from the facility to provide information regarding the quality of ground water entering the site, to act as background data.

All of the proposed monitoring wells are to be completed in the upper aquifer; however, as shown on the ground water sampling location map (Figure 1-3), four of the wells are to be in the deep zone of the aquifer, just above the contact with the underlying till confining layer so that the entire thickness of the aquifer is being monitored. This contact is estimated to be approximately 30 to 50 feet below the surface, according to drilling logs of the existing monitoring wells. The remaining six wells are to be in the shallow zone of the upper aquifer. This combination of well depths will enable data to be obtained regarding compounds both more and less dense than water. The specific depths of the wells will be determined as the borings are drilled.

1.9.2 Surface Water Sampling

Samples of surface water will be collected from the on-site pond, the off-site pond, the Mississinewa River, and Lugar Creek (Figure 1-3). Sampling points on the river will be located at three areas evenly distributed adjacent to the landfill site, downstream of the landfill site at one location, and upstream of the landfill site at one location to serve as background data. One sampling point will be located along Lugar Creek to provide data on the quality of water discharging from Lugar Creek, two will be from the on-site pond, and two more will be from the off-site pond. The pond samples are located at what has been determined by the US EPA to be inflow and outflow locations.

1.9.3 Sediment Sampling

Fine grain sediment samples will be collected in the general vicinity of the surface water sampling locations in the Mississinewa River and Lugar Creek (Figure 1-3). The sediment samples will be collected from a location between mid-river and the left shore (facing downstream) to reflect any "sideness." Sediment sampling is a one time event which will coincide with the initial surface water sampling event.

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1.9.4 Sampling Summary Matrix

A sampling summary matrix is presented as Table 1-1. The table provides the matrices, parameters and sampling frequency for the Monitoring and Additional Studies to be conducted at the Marion (Bragg) Landfill.

1.10 Project Schedule

Figure 1-4 presents an estimated project time line by task.

TABLE 1-1
Sample Summary Matrix
Marion (Bragg) Landfill

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Matrix	Number of Samples	Number of Trip Blanks*	Number of Field Blanks*	Number of Field Duplicates	Number of Matrix Spike/Matrix Spike Duplicate Samples**	Matrix Total	Analyses	Container and Preservation	Holding Time
Ground Water (Initial and semi-annual sampling. Confirmatory samples shall be taken during the quarter following the sampling event that revealed the presence of a parameter requiring such confirmatory sampling. Sampling is anticipated for 30 years.)	10	3	1	1	2	15	LABORATORY TCL Volatiles	2-40 ml screw cap vials w/ Teflon lined septa. HCl to pH \leq 2. Cool to 4° C.	14 days
							pH Check	1-40 ml screw cap vial w/ teflon lined septa. HCl to pH \leq 2. Cool to 4° C.	
							TCL BNAs	2-1 liter amber glass w/ teflon lined enclosure. Cool to 4° C.	7 days until extraction, 40 days after extraction.
							Dissolved TAL Metals	Dissolved samples will be field filtered through a 0.45 μ m filter prior to preservation.	6 months (28 days for Hg)
								1-plastic liter. HNO ₃ to pH \leq 2.	
							Total Cyanide	1-liter plastic w/ Teflon lined enclosure. NaOH to pH \geq 12. Cool to 4° C.	14 days until distillation
							TSS, Chloride	1-500ml plastic. Cool to 4° C.	7 days (TSS), 28(Cl)
							COD, NH ₃ -N	2-1 liter glass w/ Teflon lined enclosure. H ₂ SO ₄ to pH \leq 2. Cool to 4° C.	28 days (both)
							FIELD pH, Conductivity D.O. and Temp.	Measure in field immediately after collection	in field

* - Trip blanks are required for volatile organic analysis at a frequency of one per cooler shipped containing volatile organic analysis.

** - Triple the volume for ground water and surface water locations will be collected for matrix spike/matrix spike duplicate analyses at a frequency of one per 20 investigative samples. Inorganic analyses will include a single matrix spike and a laboratory duplicate versus a matrix spike duplicate.

TABLE 1-1
Sample Summary Matrix
Marion (Bragg) Landfill

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Matrix	Number of Samples	Number of Trip Blanks*	Number of Field Blanks*	Number of Field Duplicates	Number of Matrix Spike/Matrix Spike Duplicate Samples* **	Matrix Total	Analyses	Container and Preservation	Holding Time
Surface Water (Initial and semi-annual sampling. Confirmatory samples shall be taken during the quarter following the sampling event that revealed the presence of a parameter requiring such confirmatory sampling. Sampling is anticipated for 30 years.)	10	3	1	1	2	15	LABORATORY		
							TCL Volatiles	2-40 ml screw cap vials w/ Teflon lined septa. HCl to pH \leq 2. Cool to 4° C.	14 days
							pH Check	1-40 ml screw cap vial w/ teflon lined septa. HCl to pH \leq 2. Cool to 4°C.	
							TCL BNAs	2-1 liter amber glass w/ teflon lined enclosure. Cool to 4°C.	7 days until extraction, 40 days after extraction.
							Total & Dissolved TAL Metals	Dissolved samples will be field filtered through a 0.45 um filter prior to preservation.	6 months (28 days for Hg)
								1-liter plastic. HNO ₃ to pH \leq 2.	
							Total Cyanide	1-liter plastic w/ Teflon lined enclosure. NaOH to pH \geq 12. Cool to 4°C	14 days until distillation
							TSS, Chloride	1-500ml plastic. Cool to 4° C.	7 days (TSS), 28 (Cl)
							COD, NH ₃ -N	2-1 liter glass w/ Teflon lined enclosure. H ₂ SO ₄ to pH \leq 2 Cool to 4° C.	28 days (both)
							FIELD pH, Conductivity D.O. and Temp.	Measure in field immediately after collection	in field

* - Trip blanks are required for volatile organic analysis at a frequency of one per cooler shipped containing volatile organic analysis.

** - Triple the volume for ground water and surface water locations will be collected for matrix spike/matrix spike duplicate analyses at a frequency of one per 20 investigative samples.
 Inorganic analyses will include a single matrix spike and a laboratory duplicate versus a matrix spike duplicate.

TABLE 1-1
Sample Summary Matrix
Marion (Bragg) Landfill

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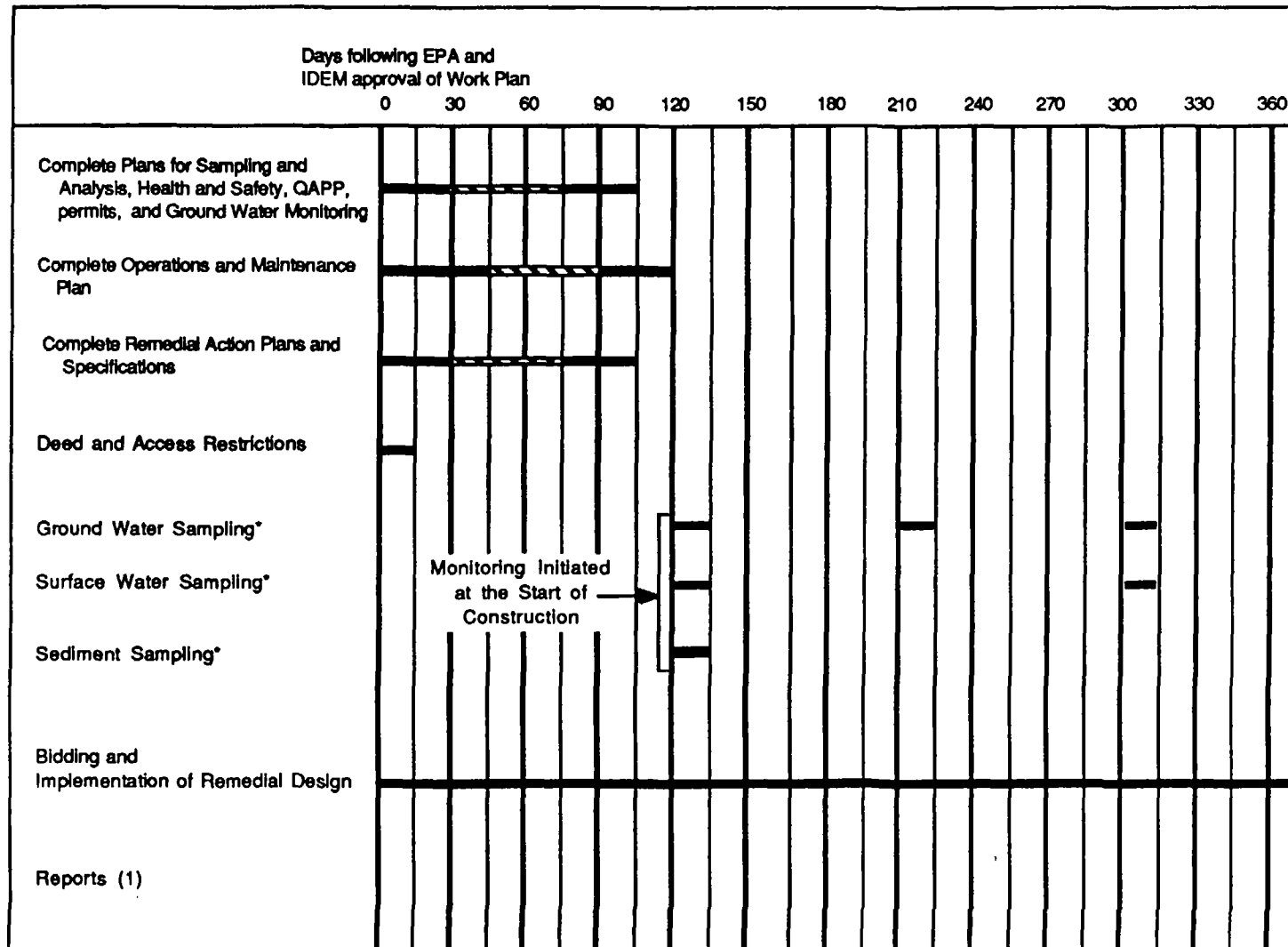
Matrix	Number of Samples	Number of Trip Blanks*	Number of Field Blanks*	Number of Field Duplicates	Number of Matrix Spike/Matrix Spike Duplicate Samples**	Matrix Total	Analyses	Container and Preservation	Holding Time
Ground Water (Quarters between the semi-annual sampling when only the IDEM Parameter List is to be sampled.)	10	3	1	1	2	15	TSS, Chloride	1-500ml plastic. Cool to 4° C.	7 days (TSS), 28 (Cl)
							COD, NH3-N	2-1 liter glass w/ Teflon lined enclosure. H2SO4 to pH ≤ 2 Cool to 4° C.	28 days (both)
							FIELD pH, Conductivity D.O. and Temp.	Measure in field immediately after collection.	In field
Sediments	6	1	1	1	2 (Triplicate volume not required)	9	LABORATORY TCL Volatiles	1 glass 4 oz. wide mouth w/ Teflon lined enclosure. Cool to 4 °C.	14 days
							TCL BNAs	1 glass quart wide mouth w/ Teflon lined enclosure. Cool to 4 °C.	7 days until extraction, 40 days after extraction
							TAL Metals	Same container as above	6 months (28 days for Hg)
							Total Cyanide	Same container as above	14 days until distillation
							TOC	Same container as above	28 days
							Grain size Distribution	1 glass quart w/ Teflon lined enclosure Cool to 4°C.	NA

* - Trip blanks are required for volatile organic analysis at a frequency of one per cooler shipped containing volatile organic analysis.

** - Triple the volume for ground water and surface water locations will be collected for matrix spike/matrix spike duplicate analyses at a frequency of one per 20 investigative samples.
Inorganic analyses will include a single matrix spike and a laboratory duplicate versus a matrix spike duplicate.

Figure 1-4

Remedial Design/Remedial Action Schedule



Key
 Group Activity
 EPA Activity

* - Ground water sampling is conducted quarterly, surface water sampling is conducted semi-annually and sediment sampling is conducted as a one-time event coinciding with the initial sampling event. Ground water and surface water sampling will continue for the duration of the 30 year monitoring period until revised with EPA/IDEM approval.

1 - Monthly reports submitted by the 15th of the month following the effective date of the CO. During post-termination of monitoring, reports will be submitted following completion of the annual monitoring..

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SECTION 2

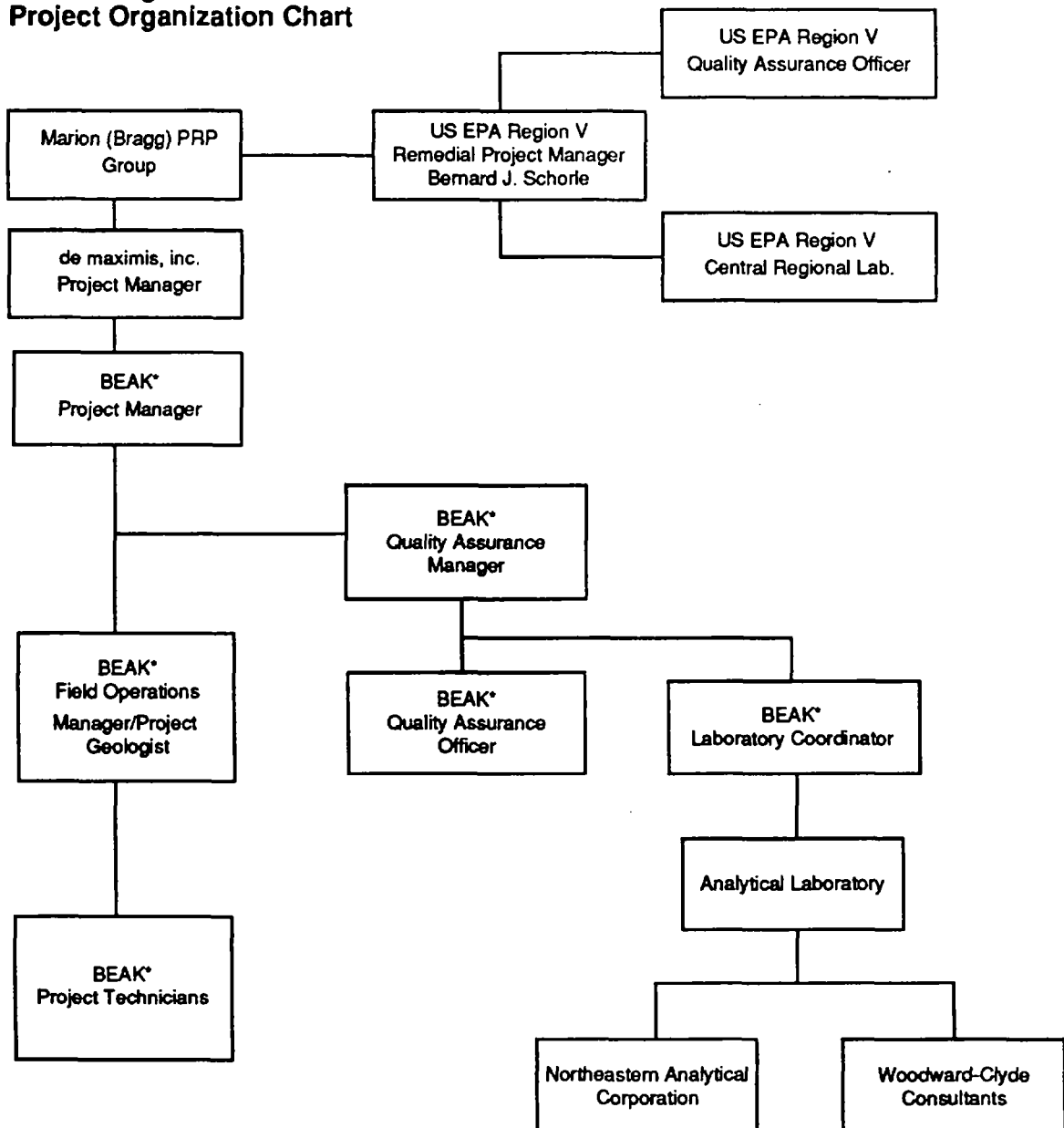
PROJECT ORGANIZATION AND RESPONSIBILITY

US EPA Region V and IDEM will provide regulatory oversight for the Remedial Action Monitoring and Additional Studies investigation. While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically delegated responsibilities. These are the Group's Project Manager, Project Manager*, the Quality Assurance Manager*, the Quality Assurance Officer*, the Laboratory Coordinator*, the Field Operations Manager/Project Geologist*, and the Project Technicians*. A single person may serve more than one of the positions identified. CompuChem Laboratories, Inc. of Research Triangle Park, North Carolina, will provide all TCL/TAL and TOC analytical services for this investigation. CompuChem will subcontract Northeastern Analytical Corporation of Marlton, New Jersey for ammonia-nitrogen, COD and chloride analyses. Each laboratory was responsible for preparation of their own analytical SOPs referenced later in this QAPP. CompuChem will subcontract Woodward Clyde Consultants of Plymouth Meeting, Pennsylvania for grain size analysis. Specific laboratory personnel with quality assurance/quality control responsibilities include the Laboratory Quality Assurance Officer and Laboratory Sample Custodian. Figure 2-1 presents a project organization flow chart.

* Denotes Beak Consultants Limited staff.

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Figure 2-1
Project Organization Chart



* Beak Consultants Limited

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2.1 US EPA Remedial Project Manager

Mr. Bernard J. Schorle will serves as the US EPA's Region V Remedial Project Manager with the responsibility of providing regulatory oversight.

2.2 US EPA Quality Assurance Officer

The Quality Assurance Officer (QAO) is responsible for review and approval of the QAPP.

2.3 Central Regional Laboratory

The Central Regional Laboratory (CRL) has the responsibility for external lab performance and system audits in addition to external audits of field activities.

2.4 IDEM Project Coordinator

The IDEM Project Coordinator will work with the US EPA RPM in providing regulatory oversight as defined in the CD.

2.5 Group's Project Manager

de maximis is the Group's Project Manger with responsibility for the direction of the Group's contractor(s), monitoring progress of all aspects of the project, and preparation and contact with local, state, and federal agencies.

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2.6 Contractor's Project Manager

The Project Manager is responsible for oversight and coordinating of the various elements of the monitoring and additional studies.

The Project Manager maintains routine contact with the investigation's progress, regularly reviews the project schedule, and reviews all major work elements prior to submittal. The Project Manager oversees all scheduling and budgeting and serves as the prime contact with the Group.

2.7 Quality Assurance Manager

The Quality Assurance Manager's responsibilities include the development, evaluation, and documentation of the Quality Assurance Project Plan and field standard operating procedures (SOPs) appropriate to the investigation. Additional responsibilities include reviewing project plans and revising the plans to assure proper quality assurance is maintained. The Quality Assurance Manager is also responsible for all data processing activities, data processing quality control, and final analytical data quality review. The Quality Assurance Manager is also responsible for final review of all Tentatively Identified Compounds (TICs) mass spectral matching quality.

2.8 Quality Assurance Officer

The Quality Assurance Officer has primary responsibility for overall project quality assurance. The Quality Assurance Officer is responsible for field quality assurance, and all other non-

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analytical data quality review. It is a major responsibility of the Quality Assurance Officer to insure that all personnel have a good understanding of the project quality assurance plan, an understanding of their respective roles relative to one another, and an appreciation of the importance of the roles to the overall success of the program.

2.9 Laboratory Coordinator

The Laboratory Coordinator has the primary responsibilities of coordinating communication between the project team and the subcontracted laboratory. Further duties include scheduling analytical services and informing the laboratory of sample shipment and expected receipt dates; issuing chain-of-custody and traffic report forms; tracking, logging, and filing documentation returned from the laboratory; and routing analytical data to the Quality Assurance Manager for validation review.

2.10 Field Activity Responsibilities

A Field Operations Manager/Project Geologist will be assigned to this project. The Field Operations Manager/Project Geologist is responsible for the day-to-day activities of all field personnel. Further responsibilities include the verification for accuracy of field notebooks, drillers' logs, chain-of-custody records, sample labels, and all other field-related documentation.

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2.11 Project Technicians

All sampling tasks required by this investigation will be conducted by experienced environmental technicians. Their responsibilities will include the documentation of the proper sample collection protocols, sample collection and field measurements, equipment decontamination, and chain-of-custody documentation.

2.12 CompuChem Laboratories Quality Assurance Officer

The volume of analytical work for a project of this size necessitates the subcontract analytical laboratory specify a Quality Assurance Officer whose duties are specific to the project. Mr. Robert Meierer will serve as CompuChem Laboratories' Quality Assurance Officer with the responsibility for maintenance of all laboratory quality assurance activities in association with the project. As Northeastern Analytical Corporation and Woodward Clyde Consultants will be subcontracted by CompuChem to perform specific analyses, CompuChem's Quality Assurance Officer will also be responsible for ensuring their subcontractor follow the procedures specified in this plan.

2.13 Laboratory Sample Custodian

Mr. Louis Dickens and Mr. Jeffrey Morrissey will serve as project Laboratory Sample Custodians for CompuChem Laboratories. The Sample Custodian's responsibilities include ensuring proper sample entry and sample handling procedures by laboratory personnel.

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SECTION 3

QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

Specific objectives, intended data usages and data quality objectives for the monitoring project are specified in Section 1.8 of this QAPP. In order to achieve these objectives, specific data quality requirements such as detection limits, criteria for accuracy and precision, sample representativeness, data compatibility and data completeness will be specified. These requirements will be established such that there is a high degree of confidence in the measurements.

The sample media that will be collected is ground water, surface water, and river sediments. The specific analytical parameters for the samples collected during the investigation are specified in Section 1 of this QAPP.

As stated earlier, the criteria that will be used to specify data quality requirements and to evaluate the analytical system performance are precision, accuracy, representativeness, completeness and comparability (PARCC). Table 3-1 presents definitions for these criteria.

3.1 Field Investigation Quality Objectives

The objectives with respect to the field investigation are to maximize the confidence in the data in terms of PARCC.

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TABLE 3-1
DEFINITIONS OF DATA QUALITY INDICATORS

- Precision - a measure of the reproducibility of measurements under a given set of conditions.
- Accuracy - a measure of the bias that exists in a measurement system.
- Representativeness - the degree to which sample data accurately and precisely represent selected characteristics.
- Completeness - a measure of the amount of the valid data obtained from the measurement system compared to the amount that was expected under ideal conditions.
- Comparability - express the confidence with which one data set can be compared with another.

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In terms of precision and accuracy, Section 9 presents the frequency with which field duplicates, travel blanks, field blanks, and matrix spikes will be collected such that the specific degree of precision and accuracy can be calculated. The data quality objective for field duplicates is to achieve precision equal to or greater than that specified in Table 3-2.

Acceptable sample precision can be attained by careful sample homogenizing when appropriate. Precision will be calculated as relative percent difference (RPD) if there are only two (2) analytical points and relative standard deviation (RSD) if there are more than two (2) analytical points. The submission of field and travel blanks will provide a check with respect to accuracy. Although accuracy is best assessed by evaluating the results of blanks, blanks do not monitor analyte losses. The submission of blanks will, however, monitor errors associated with the sampling process, field contamination, preservation, handling, and laboratory contamination. The data quality objective for field and travel blanks is to meet or exceed the quantitation limit presented in Table 7-2. In the event that the blanks are contaminated and/or poor precision is obtained the associated data will be qualified as described in Section 8.3. Through the submission of field QC samples the distinction can be made between laboratory problems, sampling technique, and sample matrix variability.

Precision and accuracy for the field pH, temperature, dissolved oxygen and conductivity measurements are dependent on the type and condition of the instrument used and the care used in the standardization and operation. The precision and accuracy objectives for the instrumentation used are as follows:

- o pH precision will be ± 0.1 pH standard units and an accuracy of ± 0.05 pH standard units.

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**TABLE 3-2
CRITERIA OBJECTIVES**

<u>Precision Objectives</u>	<u>Aqueous</u>	<u>Solid/Other</u>
Field Duplicate/Replicates (Blind or labeled)		
VOA	within 20% RPD	within 30% RPD
BNA	within 25% RPD	within 40% RPD
Inorganics	within 25% RPD	within 40% RPD
Wet Chemistry Parameters	within 25% RPD	within 40% RPD
Laboratory Duplicates (Unspiked)		
VOA	within 20% RPD	within 30% RPD
BNA	within 25% RPD	within 40% RPD
Inorganics	As specified in CLP	Inorganic SOW*
Wet Chemistry Parameters	within 25% RPD	NA
Laboratory Duplicate (MSD)		
VOA	As specified in CLP Organic SOW**	
BNA	As specified in CLP Organic SOW**	
Wet Chemistry Parameters	within 20% RPD	NA
<u>Accuracy Objectives</u>		
Field or travel blanks		
VOA	Less than the CRQL	
BNA	Less than the CRQL	
Inorganics	Less than the CRQL	
Wet Chemistry Parameters	Less than the CRQL	
Laboratory Blanks		
VOA	As specified in CLP Organic SOW**	
BNA	As specified in CLP Organic SOW**	
Inorganics	As specified in CLP Organic SOW*	
Wet Chemistry	Less than the Quantitation Limit (QL)	
Matrix spikes/surrogate spikes		
All organic fractions	As specified in CLP Organic SOW**	
Inorganics	As specified in CLP inorganic SOW*	
Wet Chemistry Parameter	79 - 116%	NA
Post-digestion spikes		
Inorganics	As specified in CLP Inorganic SOW*	

*(12/87 or most recent)

** (12/88 or most recent)

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- o Temperature precision will be ± 1 degree Celcius and an accuracy of ± 1 degree Celcius.
- o Dissolved oxygen precision will be ± 0.025 mg/L on the 0-5 scale, ± 0.05 mg/L on the 0-10 scale and ± 0.1 mg/L on the 0-20 scale, and an accuracy of $\pm 1\%$ of the full scale.
- o Conductivity precision will be ± 3 umhos/cm on the 500 umhos/cm range, ± 25 umhos/cm on the 5,000 umhos/cm range, and ± 250 umhos/cm on the 50,000 umhos/cm range. Accuracy for the conductivity measurements are a function of the conductivity reading for the probe and instrument combined and is given in Figure 2, page A2-8 of Attachment 2 of this QAPP.

To assure samples representativeness all sample collection will be performed in accordance with the US EPA-recommended procedures for the collection, and preservation, and holding times specified in the Federal Register, 26 October 1984, the CLP RAS Organic SOW (2/88 or most current), the CLP RAS Inorganic SOW (12/87 or most recent), and the field and analytical SOPs presented in this QAPP.

The data quality objective for the completeness of data with respect to the sampling is 100%. Although this goal appears rather ambitious, it can be attained. In the event 100% is not obtained, the effect of the uncollected data will be evaluated by the Project Manager as to its impact (if any) on project objectives. Corrective actions will be initiated to resolve any data gaps from the original objectives, found as a result of less than 100% data completeness.

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Every effort will be made to obtain valid data for all sampling points particularly those classified as critical points. In this regard the critical point samples which are identified will necessarily be selected as subsequent QC samples (duplicate and matrix spikes) at the frequency specified in Section 9. Critical sampling points are those which will directly answer questions posed in the design of overall project objectives (Section 1.8).

In order to establish a degree of comparability such that observations and conclusions can be directly compared with all historical data, standardized methods of field analysis, sample collection, holding times and preservation will be used. In addition, field conditions will be considered as well as sampling in order to attain a high degree of data comparability.

3.2 Laboratory Quality Objectives

The laboratory will demonstrate analytical precision and accuracy, by the analysis of laboratory duplicates and matrix spike duplicates (inorganic analyses will include a laboratory duplicate and a matrix spike while organic analyses will include a matrix spike and matrix spike duplicate). Precision will also be demonstrated (as well as instrument stability) by comparison of response factors for calibration standards. Laboratory accuracy will be demonstrated by the addition of surrogate and matrix spikes compounds. Accuracy will be presented as percent recovery. Precision will be presented as relative percent difference (RPD), relative standard deviation (RSD), or percent difference (PD) whichever is applicable to the type of QC samples. Laboratory blanks will also demonstrate accuracy with respect to the analyses. The frequency of laboratories duplicates, matrix spikes and laboratory blanks are specified in Section 9. As considerable reference is made to Attachment 1 in the remainder of this QAPP, it is suggested it be reviewed at this time. CompuChem Laboratories, Inc., data quality objectives are detailed in Attachment 1 to this QAPP.

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The analysis laboratory will be expected to process (purge, extract or digest) an aliquot of sample such that the analytical results will provide a high degree of representation with respect to the sampling point. In addition the analysis laboratory will be expected to document all analytical problems encountered during the course of the investigation. This will enable the project to achieve a 100% completeness goal through a phased sampling approach. Further the laboratory will be required to provide all data packages in full CLP deliverables for the TCL/TAL analyses and an equivalent level of deliverables for the remaining analyses (refer to Section 8) as to assure that analytical methods, parameters, and reporting units are compatible with other existing data.

3.3 Criteria Objectives

The quantitative objectives (criteria) that will be required for both field and laboratory accuracy and precision are summarized in Table 3-2.

The laboratory will be expected (as an ideal objective) to report the CLP TCL contract required quantitation limits (CRQL), CLP TAL contract required detection limits (CRDL) or wet chemistry quantitation limits (QL) for all samples in the appropriate statistical reporting units for all analyses. However, it should be noted that actual quantitation limits are sample specific and depend on variables such as dilution factors, sample matrices and the specific analyte. The handling of data reported at or near the CRQL/CRDL or QL will be done cautiously since the stated data quality objectives for accuracy and precision may not "translate" well in some situations.

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3.4 Data Management Objective

It is a data management objective that all aspects of the investigation from sample design, collection, shipment, analysis use/decisions, etc. be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this document.

It is expected that by the design of separate data quality requirements for field sampling and laboratory analysis, clear distinctions can be made such that any problems found in the system can be isolated with respect to the cause. Conversely, the data quality requirements are also designed to provide an indication of the variability inherent to the overall system.

Through the use of a phased approach of sampling, analysis, data assessment (data review), data qualification, and feedback the overall data management objective is to provide a complete data base with a high degree of confidence that will thoroughly characterize the environmental media in and around the study area.

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SECTION 4

SAMPLING PROCEDURES

The sampling procedures for the Monitoring and Additional Studies are presented in the "Sampling and Analysis Plan, Marion (Bragg) Landfill" included as Attachment 4. The "Ground Water Monitoring Plan, Marion (Bragg) Landfill" presents further details on the site ground water sampling and is included as Attachment 5. At the time the bioaccumulation study and biological survey are determined to be necessary, an addendum to this QAPP will be prepared and submitted to US EPA for review.

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SECTION 5

SAMPLE CUSTODY

5.1 Field Activities - Sampling and Measurements

The primary objective of sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during this investigation will be maintained by the Field Operations Manager (FOM) or the field personnel collecting the samples. The FOM or field personnel are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

Field measurements for pH, specific conductance, and temperature and D.O. will be obtained on ground water samples immediately following sample collection. A grab sample collected in a beaker will be used to obtain measurements. Surface water samples will be measured in situ.

5.2 Chain-of-Custody Procedure

CompuChem receives Series 200 sample bottles from I-Chem of Hayward, CA. All necessary sample bottles (including those for analyses performed by Northeastern) will be shipped overnight by CompuChem Laboratories and received by the FOM or field personnel. Therefore, the chain-of-custody will be initiated by CompuChem with the release of sample bottles. All necessary chemical preservatives will be added to the bottle by the FOM or field

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personnel immediately upon bottle receipt. Sample bottles needed for a specific sampling task will then be relinquished by the FOM to the sampling team after the FOM has verified the integrity of the bottles and assured that the proper bottles have been assigned to the task to be conducted.

As samples are collected and placed in coolers, custody will be maintained by the FOM or sampling team until shipment to the laboratory. The specific handling and shipment procedures are described below under Sample Packing, Handling and Shipment.

5.2.1 Sample Packing, Handling and Shipment

A self-adhesive sample label (Figure 5-1) will be affixed to each container before sample collection to minimize label loss during handling of the container. At a minimum, the sample label will contain:

- o Sample identification - place of sampling
- o Date collected
- o Testing required

In order to further document details regarding the sample identification, the following number system will be used:

1. The first two symbols will indicate the sample medium:

GW - Ground Water	PW - Pond Water
SW - Surface Water	SE - Sediment

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FIGURE 5-1
SAMPLE CONTAINER LABEL

SAMPLING
S-ID#: _____ DATE: _____
ANALYZE FOR/CODE: _____

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2. The next number will indicate the number of the sample collected on that specific day for that medium:

Ex: GW01 then GW02

3. The next symbol, if present, will indicate the type of QC sample (if applicable):

TB - Trip Blank DP - Duplicate
FB - Field Blank MS - Matrix Spike
MSD - Matrix Spike Duplicate

4. The last two letters will be the initials of the sampler:

EX: GW02TBRV

Immediately after sample collection, each sample bottle will be sealed in an individual plastic bag. Samples will then be placed immediately into an insulated cooler for shipment to the laboratory. Field Chain-of-Custody records (Figure 5-2) and a Traffic Report (Figure 5-3), completed at the time of sample collection, will accompany the samples inside the cooler for shipment to the laboratory.

A sequentially numbered traffic report is prepared for each sample and provides a unique sample code for identifying the sample as well as sample location, collection date, sample type, analyses required, etc. The samples will be properly relinquished on the field Chain-of-Custody record by the sampling team. These record forms will be sealed in a ziplock plastic

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CHAIN OF CUSTODY RECORD

CHAIN OF CUSTODY RECORD

[illegible]

COPIES: White & Yellow copies accompany sample shipment to laboratory. White copy to be returned to BEAK for files. Pink copy retained by sampler. Gold copy extra as needed (warehouse).

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FIGURE 5-3

Traffic Report

beak beak
consultants
limited

1 Project No.		2 Sample Concentration		Nº 046	
Project Name/Location		<input type="checkbox"/> low <input type="checkbox"/> medium		3 Ship to:	
4 Sample Matrix		5 Sampling Personnel Contact			
<input type="checkbox"/> liquid <input type="checkbox"/> other <input type="checkbox"/> solid		sampler project manager phone number		Attn:	
6 Shipping Information		7 Specify Type of Analyses, Number of Containers, - Volume			
name of carrier		Analyses/Method Requested		No. of Bottles	Total Volume
date shipped					
airbill number					
8 Sample Location					
Date:					
Time:					
9 Sample Description		10 Special Handling (e.g. Safety Procedures/Hazardous)			
<input type="checkbox"/> surface water <input type="checkbox"/> other: _____ <input type="checkbox"/> groundwater _____ <input type="checkbox"/> leachate _____ <input type="checkbox"/> sediment _____ <input type="checkbox"/> soil _____		additional comments (specify data package, rush work, special detection limits, etc.)			
11 Condition of Samples Received (to be completed by Laboratory Log-In)					
<input type="checkbox"/> samples received intact <input type="checkbox"/> samples at 4°C <input type="checkbox"/> samples not leaking <input type="checkbox"/> container numbers match as specified in item 7 <input type="checkbox"/> container tags match chain of custody <input type="checkbox"/> cooler received with custody seals intact <input type="checkbox"/> samples contained within plastic bags					
					Log-In Person's Signature _____ _____

White and yellow copies accompany sample shipment to laboratory. Yellow copy retained by laboratory. White copy returned to BEAK for files. Pink copy retained by sampler. Green copy extra copy as needed.

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bag to protect them against moisture. Each cooler will contain sufficient ice and/or ice packs to ensure that proper temperature is maintained, and will be packed in a manner to prevent damage to sample containers. The FOM will then initial and custody seal (Figure 5-4) each sample cooler. All coolers will be shipped by an overnight courier according to current US DOT regulations. Prior to releasing the coolers, the FOM will require the courier to sign a Cooler Transfer Acknowledgment (Figure 5-5). Upon receiving the samples, the laboratory Sample Custodian will inspect the condition of the samples, compare the information on the sample labels against the field Chain-of-Custody record and Traffic Reports, assign a CompuChem Laboratory control number, and log the control number into the computer sample inventory system.


5.2.2 Laboratory Analysis

The Laboratory Sample Custodian will note any damaged sample containers or discrepancies between the sample label and information on the field Chain-of-Custody record when logging the sample and will note any discrepancies in Section 11 of the Traffic Report. This information will also be communicated to the FOM or field personnel so proper action can be taken. The Chain-of-Custody form will be signed by both the relinquishing and receiving parties each time the sample changes hands, and the reason for transfer indicated.

When samples requiring preservation by either acid or base are received at the laboratory, the pH will be measured and documented. The two sample vials for TCL volatile analysis preserved with acid will not be subjected to pH analysis. A third TCL volatile sample vial will be collected and preserved at each sampling location exclusively for pH determination. The Laboratory Sample Custodian will then store the sample in a secure sample storage cooler maintained at 4°C and maintain custody until the sample is assigned to an analyst for analysis.

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FIGURE 5-4
CUSTODY SEAL

 **COMPUCHEM
LABORATORIES** **CUSTODY SEAL**

Signature Date

COOLER TRANSFER ACKNOWLEDGEMENT

DATE TIME	CLIENT / PROJECT CLIENT NUMBER	NUMBER OF COOLERS	ERM RELEASE (SIGNATURE)	RECEIVED BY (SIGNATURE)	DATE TIME

FIGURE 5-5
COOLER TRANSFER
ACKNOWLEDGEMENT

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An internal Chain-of-Custody form will be used by CompuChem Laboratories to document sample possession from laboratory Sample Custodian to Analysts and final disposition. CompuChem will also use chain-of-custody procedures to document transfer of samples to their subcontractor, Northeastern. Northeastern's chain-of-custody procedures will be equivalent to that specified in the CLP. CompuChem's internal Chain-of-Custody procedures are documented in Attachment 1, Section 7.4. All Chain-of-Custody information will be supplied with the data packages for inclusion in the document control file.

5.3 Final Evidence File - Content and File Maintenance

The purpose of an evidence file is to establish a central location for all written records. The final evidence file will include, but is not limited to, all notes, logbooks, phone conversation records, internal memos, budgets, correspondence, all analytical data (See Section 8) worksheets, chain-of-custodies reports, traffic reports, and analytical requests pertaining to the Marion (Bragg) Landfill Site. A description of the expected evidence file contents are detailed below:

<u>File Number</u>	<u>File Title</u>	<u>Description of Contents</u>
701710000 Series	Administrative File	Contract
701710001	Accounting	Monthly Invoices
701710002	Subcontracts	Agreements with Labs, Drillers, and other Sub-contractors
701710003	Site Specific Documents	CD, ROD, RD/RA Work Plan, RAP, QAPP, etc.
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<u>File Number</u>	<u>File Title</u>	<u>Description of Contents</u>
701710004	Monthly Reports	By Month
701710005	Incoming Correspondence	By Date
701710006	Outgoing Correspondence	By Date
701710010	Monitoring and Additional Studies File	
701710011	Ground Water Sampling	All related field information, raw field data, and reduced field data.
701710012	Surface Water Sampling	All related field information, raw field data, and reduced field data.
701710013	Sediment Sampling	All related field information, raw field data, and reduced field data.
701710014	Analytical Data	All raw data packages (see contents in Section 8) and reduced data.
701710015	Quality Assurance Validation Reviews	Reports and validation Support documentations
701710016	Chain-of-Custodies	Original with all signatures
701710017	Traffic Reports	Original with all signatures
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<u>File Number</u>	<u>File Title</u>	<u>Description of Contents</u>
701710018 Series	Audit Reports	QA Field and Laboratory audits

CompuChem will maintain all original hardcopy analytical results, (including these of Northeastern) and magnetic tapes of GC/MS results indefinitely. Hardcopy data is maintained in an off-site locked warehouse and electronic (magnetic) data is maintained in an environmentally controlled, off-site locked warehouse. Both warehouses have restricted access to only the sample custodian or facilities manager, or their designated personnel.

Original samples will be held by the laboratories for thirty (30) days after submission of the analysis results and data packages. Extracts prepared from the samples will be held one hundred eighty (180) days after submission of the analysis results and data packages.

A secure, limited access room will be used to house the evidence file. The final evidence file will be maintained by Beveridge & Diamond, PC common counsel for the Group. The Project Manager is responsible for maintenance of a duplicate copy of all sampling and analytical related evidence necessary for the final evidence file. The final evidence file will be maintained for ten years after completion of the program. Permission will be requested from US EPA Region V's RPM for disposal or transmittal of the final evidence file.

Specific details of the retention and availability of information is provided in the CD.

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SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

6.1 Laboratory Calibration

Laboratory calibration and frequency for the required methods are specified for this study are presented in the CLP RAS Organic SOW (2/88 or most recent), CLP RAS Inorganic SOW (12/87 or most recent), and the method Standard Operating Procedures (SOPs) used by CompuChem and Northeastern. These SOPs are included as Attachment 3.

6.2 Field Calibration

In addition to the laboratory analyses conducted during the course of this investigation, field measurements of pH, specific conductance, temperature, and D.O. will be taken for all surface and ground water samples. Instrument manuals for the pH, conductivity and D.O. meters are included in Attachment 2.

The frequency of field calibration procedures will, at a minimum, include the following:

- o The D.O., pH and specific conductance meters will be calibrated a minimum of once daily and documented in the calibrator's field book. Calibration will be checked as necessary to insure proper measurements are taken.
- o pH meters will be calibrated using specific techniques according to the manufacturer's instructions and two standard buffer solutions (either 4, 7, or 10) obtained from

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chemical supply houses. The pH values of these buffers will be compensated for temperature according to the values supplied on the manufacturer's bottle label. The temperature (measured as below) at which the sample pH was measured will then be used to compensate for temperature on the meter.

- o The D.O. meter will be calibrated according to the specific instrument manufacturer's recommendations. This generally involves compensation of the probe for temperature and location elevation in a moisture saturated environment.
- o Temperature measurements will be performed using field thermometers (Thomas Science No. 9329A10).
- o Specific conductance meters will be calibrated using a 1413.0 umhos (KCl) solution. The conductivity probe cell constant will be calculated according to the formula:

$$K = \frac{1413.0 \frac{1}{(C)}}{1 + 0.02(T-25)}$$

Where:

K = probe cell constant (unitless)

C = measured conductance value of standard

T = temperature (°C) of standard

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Table 6-1 will be used to correct for the standard solutions' conductivity value if it is not at 25°C.

Using the cell constant calculated above and the following formula, field specific conductance measurements will be corrected to 25°C.

$$S = \frac{K \cdot C}{(1 + 0.02 (T - 25))}$$

Where:

S = specific conductance at 25°C (umhos/cm)

K = calculated cell constant

C = field specific conductance (umhos/cm)

T = temperature (°C) of sample at which conductance was measured

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TABLE 6-1
CONDUCTIVITY TEMPERATURE CORRECTIONS
FOR 1,413 UMHOS/CM CONDUCTIVITY STANDARD

<u>Temperature, °C</u>	<u>umhos/c</u>
0	776
5	896
10	1,020
15	1,147
16	1,173
17	1,199
18	1,225
19	1,251
20	1,278
21	1,305
22	1,332
23	1,359
24	1,386
25	1,413
26	1,440
27	1,467
28	1,494
29	1,521
30	1,548

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SECTION 7

ANALYTICAL PROCEDURES

7.1 Analytical Procedures for Each Sample Matrix and/or Parameters

All analytical procedures to be used are officially approved US EPA procedures. The appropriate references are given in Table 7-1. CompuChem's and Northeastern's SOPs for the non-CLP referenced methods are included in Attachment 3 to this QAPP.

7.1.1 Sample Preparations

The specific sample preparations are detailed in the methods referenced in Table 7-1 and the SOPs.

7.1.2 Instrument Start-up and Performance Check

Details concerning instrument start-up and performance checks are specified in the methods referenced in Table 7-1 and the SOPs.

7.1.3 Initial Calibration and Continuing Calibration Check

Details concerning initial and continuing calibrations are specified in the methods referenced in Table 7-1 and the SOPs.

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TABLE 7-1
ANALYTICAL METHODS FOR
MARION (BRAGG) LANDFILL SAMPLES

<u>Analysis</u>	<u>Aqueous Samples</u>	<u>Sediment Samples</u>
TCL Volatiles	CLP SOW (1)	CLP SOW (1)
TCL Semivolatiles	CLP SOW (1)	CLP SOW (1)
TAL Inorganics (metals and cyanide)	CLP SOW (1)	CLP SOW (1)
TSS	160.2 (2)	NA
COD	410.4 (2)	NA
NH ₃ -N	417A & 417B (3)	NA
Chloride	407A (3)	NA
TOC	NA	505 (Modified for soil, 3 & 4)
Grain Size	NA	ASTM E 112-77

-
- (1) Contract Laboratory Program Statement of Work for Organics Analysis, Multi-media, Multi-concentration (2/88 or most recent revision) or Statement of Work for Inorganics Analysis, Multi-media, Multi-concentration (12/87 or most recent).
 - (2) EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1983.
 - (3) Standard Methods for the Examination of Water and Wastes, 16th Edition.
 - (4) Modified for soil. Refer to CompuChem SOP for TOC included in Attachment 3.

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7.2 Quantitation or Detection Limits for Parameters to be Tested

A complete list of the organic compounds and inorganic constituents and the applicable quantitation or detection limits that will be required for all samples collected for the investigation is presented in Table 7-2.

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TABLE 7-2
MARION (BRAGG) LANDFILL ORGANIC COMPOUNDS
AND INORGANIC CONSTITUENTS
FOR ANALYSIS AND QUANTITATION LIMITS
TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED
QUANTITATION LIMITS (CRQL)

Volatiles	CAS Number	Quantitation Limits*	
		Low Water ^a µg/L	Low Soil/ Sediment ^b µg/Kg
1. Chloromethane	74-87-3	10	10
2. Bromomethane	74-83-9	10	10
3. Vinyl Chloride	75-01-4	10	10
4. Chloroethane	75-00-3	10	10
5. Methylene Chloride	75-09-2	5	5
6. Acetone	67-64-1	10	10
7. Carbon Disulfide	75-15-0	5	5
8. 1,1-Dichloroethene	75-35-4	5	5
9. 1,1-Dichloroethane	75-35-3	5	5
10. 1,2-Dichloroethene	540-54-0	5	5
(total)			
11. Chloroform	67-66-3	5	5
12. 1, 2-Dichloroethane	107-06-2	5	5
13. 2-Butanone	78-93-3	10	10
14. 1,1,1-Trichloroethane	71-55-6	5	5
15. Carbon Tetrachloride	56-23-5	5	5
16. Vinyl Acetate	108-05-4	10	10
17. Bromodichloromethane	75-27-4	5	5
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	5
19. 1,2-Dichloropropane	78-87-5	5	5
20. cis-1,3-Dichloropropene	10061-01-5	5	5
21. Trichloroethene	79-01-6	5	5
22. Dibromochloroemthane	124-48-1	5	5
23. 1,1,2-Trichloroethane	79-00-5	5	5
24. Benzene	71-43-2	5	5
25. trans-1,3-Dichloropropene	10061-02-6	5	5

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TABLE 7-2
(CONTINUED)

Volatiles	CAS Number	Quantitation Limits*	
		Low Water ^a µg/L	Low Soil/ Sediment ^b µg/Kg
26. Bromoform	75-25-2	5	5
27. 2-Hexanone	591-78-6	10	10
28. 4-Methyl-2-Pentanone	108-10-1	10	10
29. Tetrachloroethane	127-18-4	5	5
30. Toluene	108-88-3	5	5
31. Chlorobenzene	108-90-7	5	5
32. Ethyl Benzene	100-41-4	5	5
33. Styrene	100-42-5	5	5
34. Total Xylenes	1330-20-7	5	5

^a Medium Water Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 100 times the individual Low Water CRQL.

^b Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Volatile TCL Compounds are 100 times the individual Low Soil/Sediment CRQL.

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TABLE 7-2
(CONTINUED)

		<u>Quantitation Limits*</u>	
<u>Semi-volatiles</u>	<u>CAS Number</u>	<u>Low Water^a</u> <u>µg/L</u>	<u>Low Soil/ Sediment^b</u> <u>µg/Kg</u>
35. Phenol	108-95-2	10	330
36. bis(2-Chloroethyl) ether	111-44-4	10	330
37. 2-Chlorophenol	95-57-8	10	330
38. 1,3-Dichlorobenzene	541-73-1	10	330
39. 1,4-Dichlorobenzene	95-50-1	10	330
40. Benzyl Alcohol	100-51-6	10	330
41. 1,2-Dichlorobenzene	95-50-1	10	330
42. 2-Methylphenol	95-48-7	10	330
43. bis(2-Chloroisopropyl) ether	39638-32-9	10	330
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-Dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic Acid	65-85-0	50	1600
52. bis(2-Chloroethoxy) methane	111-91-1	10	330
53. 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol	59-50-7	10	330
59. 2-Methylnaphthalene	91-57-6	10	330
60. Hexachlorocyclopenta- diene	77-47-4	10	330

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TABLE 7-2
(CONTINUED)

		<u>Quantitation Limits*</u>	
		<u>Low Water^a</u>	<u>Low Soil/ Sediment^b</u>
<u>Semi-volatiles</u>	<u>CAS Number</u>	<u>µg/L</u>	<u>µg/Kg</u>
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-trichlorophenol	95-95-4	50	1600
63. 2-Chloronapthalene	91-58-7	10	330
64. N-Nitroaniline	88-74-4	50	1600
65. Dimethyl Phthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 3-Nitroaniline	99-09-2	50	1600
68. Acenaphthene	83-32-9	10	330
69. 2, 4-Dinitrophenol	51-28-5	50	1600
70. 4-Nitrophenol	100-02-7	50	1600
71. Dibenzofuran	132-64-9	10	330
72. 2,4-Dinitrotoluene	121-14-2	10	330
73. 2,6-Dinitrotoluene	606-20-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2- methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl Phenyl ether	101-55-3	10	330
81. Hexachlorophenol	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butyl Benzyl Phthalate	85-68-7	10	330

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TABLE 7-2
(CONTINUED)

		<u>Quantitation Limits*</u>	
<u>Semi-volatiles</u>	<u>CAS Number</u>	<u>Low Water^a</u>	<u>Low Soil/ Sediment^b</u>
		<u>µg/L</u>	<u>µg/Kg</u>
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. bis(2-ethylhexyl) phthalate	117-81-7	10	330
92. Chrysene	218-01-9	10	330
93. Di-n-octyl Phthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenzo(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330

^c Medium Water Contract Required Quantitation Limits (CRQL) for Semi-Volatile TCL Compounds are 100 times the individual Low Water CRQL.

^d Medium Soil/Sediment Contract Required Quantitation Limits (CRQL) for Semi-Volatile TCL Compounds are 60 times the individual Low Soil/Sediment CRQL.

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TABLE 7-2 (CONTINUED)
TARGET ANALYTE LIST (TAL) AND
CONTRACT REQUIRED DETECTION LIMITS

Element (TAL Inorganics)	Contract Required Detection Limit Water ($\mu\text{g/L}$)	Contract Required Detection Limit Soil ¹ (mg/Kg)
Aluminum	200	40
Antimony	60	12
Arsenic	10	2
Barium	200	40
Beryllium	5	1
Cadmium	5	1
Calcium	5000	1000
Chromium	10	2
Cobalt	50	10
Copper	25	5
Iron	100	20
Lead	5	1
Magnesium	5000	1000
Manganese	15	3
Mercury	0.2	0.1
Nickel	40	8
Potassium	5000	1000
Selenium	5	1
Sodium	5000	1000
Silver	10	2
Thallium	10	2
Vanadium	50	10
Zinc	20	4
Cyanide	10	0.5

1 - Soil CRDL's presented are based on wet weight.
Individual sample limits will be different based on dry
weight correction.

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TABLE 7-2 (CONTINUED)
IDEM PARAMETER LIST

<u>IDEM Parameter</u>	<u>Quantitation Limits</u>	
	<u>Low Water</u>	<u>Sediment</u>
	<u>µg/L</u>	<u>mg/Kg</u>
Temperature (field measurement)	NA	NA
pH (field measurement)	NA	NA
TSS	5,000	NA
Specific conductivity (field measurement)	NA	NA
COD	20,000	NA
NH ₃ -N	100	NA
Chlorides	3,000	NA
Dissolved oxygen (field measurement)	NA	NA
TOC	NA	200

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SECTION 8

DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Data Reduction

It is anticipated that the data reduction for this investigation will be minimal and will consist primarily of tabulating analytical results from CompuChem's Form Is (Analytical Reports) onto summary tables through the use of computerized spreadsheet software. All reduced data will be assigned document control identification numbers and placed in the evidence file maintained by the Project Manager. CompuChem's data reduction is discussed in Attachment 1, Section 8.5 of this QAPP.

8.2 Reporting

All analytical data obtained during the course of the investigation for ground waters and surface waters will be reported as ug/L. Laboratory data for sediment analyses will be reported as ug/Kg (TAL/TCL) and mg/Kg (wet chemistry) on a dry weight basis. Data packages associated with the TCL/TAL analyses of samples collected during the monitoring and additional studies will be prepared utilizing CLP deliverables as presented in Section B of the organic and inorganic SOWs. Deliverables associated with the wet chemistry parameters (IDEM List) will include analysis results, quantitation limits, method blank analysis results, and matrix spike and laboratory duplicate results.

A rigorous data control program will be required to insure that all documents for the investigations are accounted for when they are completed. Accountable documents include items such as log books, field data records, correspondence, chain-of-custody records,

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analytical reports, data packages, photographs, computer disks, and reports. The Project Manager is responsible for maintaining an evidence file in which all accountable documents will be inventoried.

To maintain control in the transfer of data, all copies of raw data from the field notebooks, and the data as received from the laboratory, will be entered into a data file and assigned an appropriate document control identification number. The data file will serve as the ultimate archive for all information and data generated during this investigation.

8.3 Data Validation

Data validation practices will be followed to insure that raw data are not altered and that an audit trail is developed for those data which require reduction. All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. Each project team member will be responsible for proofing all data transfers made, and the Quality Assurance Officer will proof at least ten percent of all data transfers.

CompuChem group leaders will check and validate all data generated by their group as specified in Attachment 1, Section 8.2 of this QAPP.

Upon receipt of the sample data packages, the laboratory data will again be quantitatively and qualitatively validated by the Quality Assurance Manager or staff reviewer. Data validation is discussed below in detail.

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8.3.1 Data Validation

All analytical data generated during the investigation will undergo a rigorous data validation review. This review will be performed in accordance with the "Laboratory Data Validation Functional Guidelines for the Evaluation of Organic (and Inorganic) Analysis" (US EPA, 2/88 and 7/88).

A preliminary review will be performed to verify all necessary paperwork (chain-of-custodies, traffic reports, analytical reports, laboratory personnel signatures) and raw data deliverables are present.

A detailed quality assurance review will be performed by the Quality Assurance Manager (or a staff reviewer) to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed review and interpretation of all data generated by CompuChem. The primary tools which will be used by experienced data review chemists will be guidance documents, established (contractual) criteria, and professional judgement. Table 8-1 presents the items examined during the quality assurance review.

Based upon the review of the analytical data, an organic and inorganic quality assurance report will be prepared which will state in a technical yet "user friendly" fashion the qualitative and quantitative reliability of the analytical data. The report will consist of a general introduction section, followed by qualifying statements that should be taken into consideration for the analytical results to best be utilized. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data table. These qualifier codes will serve as an indication of the qualitative and quantitative reliability.

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During the course of the data review, an organic and inorganic support documentation package is prepared which will provide the backup information that will accompany all qualifying statements presented in the quality assurance review.

Once the review has been completed, the Quality Assurance Manager will then submit these data to the Project Manager. These approved data tables and quality assurance reviews will be signed and dated by the Quality Assurance Manager.

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TABLE 8-1

ITEMS REVIEWED DURING THE DATA VALIDATION

<u>Areas Examined</u>	<u>Applicability</u> (organic, inorganic, both)
Field and Laboratory Chain of Custodies (Traffic Reports, Field Notes, etc.)	Both
Laboratory Narrative and QC Summaries	
Holding Times	Both
Extraction/Digestion Logs	Both
Blanks - field and laboratory (accuracy)	Both
Instrument Tune	Organic
Standards	Both
Linearity	Both
Sensitivity/Stability	Both
Selectivity/Specificity	Both
EPA Criteria (SPCC and LCS)	Both
Variability of Technique (internal standards)	Organic
Analyte Breakdown	Organic
Analytical Sequence	Organic
ICP Interference	Inorganic
Control Standards	Inorganic
Samples	
Detection Limits	Both
Instrument Printouts	Both
ICP data	Inorganic
AA data	Inorganic
GC data	Organic
GC/MS data	Organic
Autoanalyzer data	Inorganic
Qualitative Identification	Both
Mass spectra	
Pesticide/PCB results	
Tentatively identified compounds	

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TABLE 8-1

ITEMS REVIEWED DURING THE DATA VALIDATION

<u>Areas Examined</u>	<u>Applicability</u> (organic, inorganic, both)
Quantitative Reliability	Both
Calculations/Equations	Both
Matrix spikes (accuracy)	Both
Bias	
Matrix spike duplicates	Organic
Bias	
Accuracy and Precision	
Surrogate Spikes	Organic
Bias	
Duplicates (field and laboratory)	Both
Precision	
Representativeness	
Post-Digestion Spikes	Inorganic
Matrix Effects	

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SECTION 9

INTERNAL QUALITY CONTROL CHECKS

9.1 Laboratory Internal Quality Control Checks

CompuChem's Internal Quality Control Checks are presented in Attachment 1, Section 7.3 of this QAPP. Additional quality control checks are presented in the method SOPs presented in Attachment 3. These will be a continuation of the Field Internal Quality Control Checks presented below.

9.2 Field Internal Quality Control Checks

Field Internal Quality Control Checks will be utilized during this investigation through the use of the following:

- o Travel Blanks - These blanks consist of ultrapure, deionized water contained in the sample container with any preservatives required for that analysis. These blanks will accompany the samplers during the sampling process and will serve as QC check on container cleanliness, external contamination, and the analytical method. Travel blanks will be submitted with each cooler shipped to the laboratory for volatile organics analysis only. A travel blank will be submitted daily for sediment/solid samples which will be analyzed for volatile organics only. These solid blanks are comprised of pre-tested play sand.
- o Field (Equipment) Blanks - These blanks consist of ultrapure, deionized water that will

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be poured through the clean sampling equipment and poured into containers with any preservatives required for that analysis. Field blanks will be submitted once per matrix per 10 samples and will be analyzed for all parameters as the samples are analyzed for.

- o Field Duplicate Samples - Blind duplicate samples will be collected to allow determination of analytical precision. One duplicate sample in every ten ground water, surface water, and sediment samples will be collected and submitted for identical analysis as the true sample.
- o Matrix Spike Sample - Matrix spike/matrix spike duplicate (MS/MSD) samples will also be submitted as further QC checks. These will be collected at the frequency of one MS/MSD for every 20 samples or every 14 days, whichever is more frequent. These will allow accuracy to be determined by the recovery rates of compounds (the matrix spike and/or surrogate spike compounds defined in the analytical methods). Precision will also be assessed by comparison of matrix spike duplicate recoveries. The purpose of these laboratory spikes is to monitor any possible matrix effects specific to samples collected from the subject site. The addition of known concentrations of compounds/constituents into the sample also monitors extraction/digestion efficiency.

Matrix spike/matrix spike duplicate sample aliquots will be acquired for ground water and surface water by providing triple the necessary sample volume. Matrix spike/matrix spike duplicate sample aliquots for solid/soil analyses will be split from the designated sample location at the laboratory. The laboratory will select aliquots that are as homogeneous with respect to one another as possible to avoid precision problems related from sample inhomogeneity. The specific sample location which will be used for matrix spikes and blind

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duplicates will be chosen by the Field Operations Manager with direction from the Quality Assurance Manager. Homogenizing is discouraged prior to splitting duplicates to avoid the loss of volatile organic compounds.

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SECTION 10

PERFORMANCE AND SYSTEM AUDITS

10.1 External Audits

10.1.1 Field External Audits

All field activities by the Group or its contractors are subject to audit by the US EPA Region V Central Regional Laboratory. These audits will be coordinated with the US EPA Remedial Project Manager.

10.1.2 Laboratory External Audits

CompuChem may be the subject of laboratory audits conducted by the US EPA Region V Central Regional Laboratory. These audits may consist of review of analytical/sample handling procedures, analysis of applicable performance evaluation samples, and an on-site systems audit.

10.2 Internal Audits

10.2.1 On-Site Audit

An on-site system audit will be performed during major field activities to review all field-related quality assurance activities. The system audit will be conducted by the Quality Assurance Officer. Figure 10-1 presents a Quality Assurance Audit form. The acceptance criteria for the field audit will be adherence to the protocols presented throughout the QAPP

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FIGURE 10-1
QUALITY ASSURANCE AUDIT FORM

PROJECT _____ W.O.# _____
DATE _____ AUDIT CONDUCTED FROM _____ HR. TO _____ HR.
AUDITOR(S): _____

ON-SITE SAMPLING PERSONNEL: _____

Audit Conducted on the Following:

<input type="checkbox"/> Soil Sampling	<input type="checkbox"/> Decontamination
<input type="checkbox"/> Surface Water/Sediment	<input type="checkbox"/> Health & Safety
<input type="checkbox"/> Ground Water	

Sample Collection:

Do sampling locations agree with those specified
in the Work Plan? _____

Is the sampling location either documented
sufficiently or marked to allow it to be
found/sampled again in the future? _____

Are sampling times, Traffic Report Numbers and
sample description noted? _____

Is sampling proceeding from the suspected least
contaminated area to the most contaminated area? _____

Have sample bottles been labeled properly? _____

Have proper containers and preservatives been used? _____

Are proper sample volumes procured? _____

FIGURE 10-1

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Are samples being refrigerated/iced immediately after collection?

Does a travel blank exist for each matrix present?

Does the potential for sample cross-contamination exist based on procedures observed?

Soil Sampling (Check if not applicable ____):

Type: _____ Hand _____ Auger or Rig

Are samples being collected at proper depths?

Are samples being screened with an OVA (if specified in Work Plan and applicable)?

Is a description of soils/materials being logged?

Have soils been homogenized where applicable (specified by the Sampling Plan)?

Surface Water/Sediment Sampling (Check if not applicable ____):

Have stream flow and velocity parameters been noted?
Estimated ____ or Measured ____

Has sampling proceeded from downstream to upstream locations?

Has the sampler acquired the water sample upstream of his position to minimize suspended sediment from entering the sample?

Have water samples been collected in the mixing zone, not stagnant areas?

Have sediments been characterized as to type and size distribution?

Has the proper sediment fraction (fine, depth) been sampled for the analyses of interest?

FIGURE 10-1

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Are the selected locations effectively monitoring effects of the potential source? _____

Ground Water Sampling (Check if not applicable _____):

Have the well specifications been noted properly (i.e., Total Depth, Casing diameter, Depth-to-water to the nearest one-hundredth of a foot, etc.)? _____

Has the purge volume been calculated properly? _____

What evacuation method has been used?

☐ Bailer ☐ Submersible ☐ Bladder Pump
☐ Other (_____)

If metals are being analyzed, have the samples been field filtered? _____

Are field pH, conductivity, and temperature being measured?
Is there documentation of calibrating the instruments? _____

Has well yield been properly evaluated to determine when sample acquisition should take place (i.e., well goes dry and needs to recover). _____

Is bailer line and bailer dedicated to each well and line disposed of after use? _____

Bailer type _____ Line type _____

Have appropriate measures been taken to dispose of contaminated purge water, pump lines, bailers, etc? _____

For Domestic Wells - Has as much information on the well and distribution system been obtained, i.e., depth, casing type, diameter, treatment present, etc.? _____

Has the sample been collected prior to treatment and as close to the well head as possible? _____

Has the domestic well been purged sufficiently to reach temperature stabilization? _____

Have the weather conditions been recorded? _____

FIGURE 10-1

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Decontamination:

Has sampling equipment been decontaminated properly for the given analytes? _____

Have the proper decontamination solutions been used? _____

For large equipment (backhoes, drill rigs), has decontamination taken place in an appropriate area? _____

Has decontaminated water/solution been collected for proper disposal? _____ Where disposed? _____

Safety:

Is the proper level of protective clothing being worn for the tasks? _____ Level A _ B _ C _ D _

Is the site Health and Safety Plan present with proper emergency contacts included? _____

Is monitoring equipment present? _____ OVA _____
H₂, O₂ meter _____ Explosimeter _____ Other _____

Is the vehicle equipped with a First Aid Kit? _____

Is contaminated protective clothing being disposed of properly? _____

Are personnel aware of the contaminants present at the site? _____

General:

Are employees conducting the investigation in a professional manner? _____

Are the objectives of the sampling activities understood by the field personnel? _____

Are weather conditions affecting sample quality? _____

FIGURE 10-1

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Audit Summary and Comments:

Signed by: _____

Print: _____

Date: _____

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and Sampling and Analysis Plan. Deficiencies found during the audits will be brought to the attention of the responsible individuals and corrective action as per Section 13 of the QAPP will be initiated. Copies of the audit will be distributed to all project personnel.

Specific elements of the on-site audit include the verification of:

- o Completeness and accuracy of sample Chain-of-Custody forms, including documentation of times, dates, transaction descriptions, and signatures.
- o Completeness and accuracy of sample identification labels, including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required.
- o Completeness and accuracy of field notebooks, including documentation of times, dates, drillers' names, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, results of field measurements, soil logs, and any problems encountered during sampling.
- o Adherence to health and safety guidelines outlined in the Site Health and Safety Plan including wearing of proper protective clothing.
- o Adherence to decontamination procedures outlined in Section 4 of this QAPP, including proper decontamination of pumps and pump tubing, bailers, and sampling equipment.
- o Adherence to sample collection, preparation, preservation, and storage procedures.

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10.2.2 Laboratory Audit

10.2.2.1 Internal Laboratory Audits

CompuChem performs regular systems and performance audits, and these are described in Attachment 1, Section 10 of this QAPP. As CompuChem Laboratories participates in US EPA's Contract Laboratory Program, a laboratory audit need not be conducted.

10.2.2.2 Performance Audit of CompuChem

As CompuChem Laboratories participate in EPA's Contract Laboratory Program (CLP) for both organic and inorganic analyses, a performance audit sample will not be submitted for analyses associated with the TCL/TAL analytes. The most recent CLP Performance Evaluation samples analyzed during the investigation will be requested and reviewed to evaluate laboratory accuracy associated with the TCL/TAL analytes.

An ampule sample obtained from either the US EPA Environmental Monitoring and Support Laboratory (EMSL) - Cincinnati or a chemical supply house containing the IDEM list parameters TSS, COD, NH₃-N and chloride will be submitted blind to CompuChem as a performance audit measure for these analytes. The concentration of the performance audit sample will be close to the quantitation limit specified for the parameters in Table 7-2. The performance sample results will be compared to the true (known) values at the 95 percent confidence interval.

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Results of both the field and laboratory audit will be submitted to the Project Manager for review and incorporation into the status reports prepared for submittal to the PRP's representative.

If the results of the audit necessitate further action, the Project Manager will be notified of such and will be appraised of any action taken.

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SECTION 11 PREVENTIVE MAINTENANCE

11.1 Laboratory Maintenance

Specific routine and preventive maintenance procedures, and maintenance logs for CompuChem's instrumentation is given in Attachment 1, Section 6.4.

11.2 Field Maintenance

Field equipment will be maintained through the use of a tracking system incorporating the tagging of each equipment item. This tag identifies its most recent maintenance, battery charge, and condition. When damaged or equipment in need of repair is returned to the equipment warehouse, it is appropriately flagged for the required maintenance to be performed. This process assures only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- o Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems.
- o Cleansing of filters in the organic vapor analyzer.
- o Storage of equipment away from the elements.
- o Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries).
- o Check instrument calibrations as described in Section 6 of this QAAP.
- o Charging any battery packs for equipment when not in use.

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Spare and replacement parts stored in the field to minimize downtime include:

- o Appropriately sized batteries
- o Locks
- o Extra sample containers and preservatives
- o Bailer line
- o Additional bailers
- o OVA igniters and filters
- o OVA H₂ gas, battery charger, and support equipment
- o Spare filters for filtration apparatus.
- o Extra pH probes, conductivity probes, samples coolers, packing material, and sample location stakes.
- o Additional supply of health and safety equipment i.e., respirator cartridges, boots, gloves, tyvek, etc.
- o Additional equipment as necessary for the field tasks.

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SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Overall Project Assessment

Overall data quality will be assessed by a thorough understanding of the data quality objectives which are stated during the design phase of the investigation. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing (validating) the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, the Project Manager will closely monitor data accuracy, precision and completeness.

12.2 Field Quality Assessment

To assure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The quality assurance officer will perform field audit(s) during the investigation to document that the appropriate procedures are being followed with respect to sample (and blank) collection. These audits will include a thorough review of the field books used by the Project personnel to insure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

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The evaluation (data review) of field blanks, and other field QC samples will provide definitive indications of the data quality. If a problem that can be isolated arises, corrective actions can be instituted for future field efforts.

12.3 Internal Laboratory Data Quality Assessment

Specific measures that will be taken by CompuChem to assess data quality are presented in Attachment 1, Section 9.

12.4 Data Management Quality Assessment

As the analytical data generated from the subject investigation are validated, qualified and submitted to the Project Manager, the quality of the data will be assessed from an overall management perspective by direct comparison of analytical results obtained from previous samplings. Information that can be obtained includes comparison of results obtained from samples taken within the same general vicinity, and the identification of missing data points. By examination of the data at the "back-end" of the process, the data quality can be assessed with respect to representativeness, precision, compatibility and completeness.

12.5 Equations Used to Calculate Precision, Accuracy, and Completeness

The following equations are used to calculate precision, accuracy, and completeness.

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12.5.1 Precision

$$RPD = \frac{(D_1 - D_2)}{(D_1 + D_2)/2} \cdot 100$$

where: RPD = Relative Percent Difference
D₁ = First Duplicate Value (percent recovery)
D₂ = Second Duplicate Value (percent recovery)

12.5.2 Accuracy

$$\text{Percent Recovery} = \frac{Q_d}{Q_a} \cdot 100\%$$

where: Q_d = quantity determined by analysis
Q_a = true value

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12.5.3 Completeness

$$C = 100 \frac{V}{T}$$

where: C = Percent Completeness
V = Number of measurements judged valid
T = Total number of measurement

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SECTION 13

CORRECTIVE ACTION

13.1 CompuChem's Corrective Action

Corrective actions for CompuChem are presented in Attachment I, Section 10. CompuChem will provide documentation as to what, if any, corrective actions were initiated concerning this study and report them to ERM's Quality Assurance Manager.

13.2 Field Corrective Action

Field quality assurance activities will be reported topically to the Project Manager. Problems encountered during the study affecting quality assurance and the corrective action taken will be reported on a Corrective Action Form as presented in Figure 13-1. The Project Manager will be responsible for initiating the corrective actions and for insuring that the actions are taken in a timely manner, and that the desired results are produced. The Project Manager will report to the Quality Assurance Manager and Quality Assurance Officer on all necessary corrective actions taken, the outcome of these actions, and their effect on data produced. All corrective action taken will be reported to the PRP group and EPA Region V. The prospect of predicting problems that may occur (if any) and listing the corrective actions that will be taken are "inappropriate". If any problems are encountered, the fact that the problems and corrective action will be reported to the PRP group and EPA Region V will represent the opportunity of approval or rejection of such action.

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**FIGURE 13-1
CORRECTIVE ACTION FORM**

Corrective Action Form

Date: _____

Job Name: _____

Initiator's Name and Title: _____

Problem Description: _____

Reported To: _____

Corrective Action:

Reviewed and Implemented By: _____

cc: Project Manager - _____

QA Manager - _____

QA Officer - _____

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Date: 14 July 1989
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SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Project Manager, in conjunction with the Quality Assurance Manager and Officer, will submit summaries of all applicable quality assurance activities in the routine PRP Group's monthly progress reports. These summaries shall contain at least the following types of information:

- o The status and coverage of various laboratory and field quality assurance project activities.
- o Data quality assurance reviews including assessment of: accuracy, precision, completeness, representativeness, and comparability.
- o Significant quality assurance problems discovered, corrective actions taken, progress and improvements, plans, and recommendations for further implementation or updating of the investigative QAPP.
- o Any significant field observations noted in the field notebook during the sampling procedure.
- o A summarization of the results of performance and system audits.

Attachment 3

CompuChem's and Northeastern's Method
Standard Operating Procedures for the
Marion (Bragg) Landfill IDEM Analyses

**COMPUCHEM
LABORATORIES**MEMORANDUM

December 4, 1989

TO: Nathan R. Frank
FROM: Joe M. Bumgarner
RE: TOC SOP Comments

Since the date our current SOP was written, it was found that some soil samples contain such a high amount of carbon that detector saturation into a non-linear range occurs even when using sample sizes of 5 mg or less. Since the use of such small sample sizes contribute to poor precision and poor representation of a particular soil sample, a modification of the Donrmann DC-180 TOC analyzer was necessary. After discussing these needs with a Dohrmann Chemistry Applications Specialist, our DC-180 TOC analyzer was modified so that soil sample sizes (of very high concentration) of 10mg to 20mg could be used without saturating the analyzer's IR detector into a non-linear portion of its range. This was done by diluting the combusted sample/oxygen gas mixture prior to routing to the detector. The DC-180 TOC analyzer has the capability of calibrating on any concentration of standard. Thus, the operator can even calibrate the instrument using a standard concentration as high as 100,000 ppm or more to match the needs for a particular analysis.

Linearity is maintained even with very high concentrations of carbon samples as long as IR detector saturation is prevented.

Thus, this new technique of diluting the combusted sample-gas mixture before routing to the detector enables the use of larger sample sizes without saturating the detector. The ability to use larger sample sizes contribute to better precision.

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Instrument Procedure: Total Organic Carbon in Soil
Instrument Procedure # 802

1.0 Summary of Method

Total Organic Carbon (TOC) in soil is composed of a variety of organic compounds in various oxidation states. A high temperature combustion method is used to measure TOC in soil. A sample is introduced to a combustion oven (800 degrees C) where all carbonaceous matter is oxidized to carbon dioxide. The carbon dioxide is bubbled through an acidified liquid and then routed through a mist trap to remove water and scrub out corrosive species formed. The gas is swept to a linearized non-dispersive infrared detector which is specific for carbon dioxide measurement. Results are reported in units of mg/kg.

2.0 Interferences

Any contact with organic material may contaminate a sample. Avoid contaminated glassware, plastic containers, and rubber tubing.

3.0 Apparatus

1. Total organic analyzer, Dohrmann Model DC-180 with boat sampling module or equivalent.
2. Analytical balance capable of weighing to 0.001 mg for weighing samples and preparation of standards.
3. Sample blender or homogenizer.

4.0 Reagents

1. Reagent water, prepare method blanks and standard solutions for carbon-free water. Use of continually sparged, redistilled water is preferred.
2. Organic carbon stock solution: Prepare a 2000 ppm stock standard solution by weighing 425 mg of reagent grade Potassium Hydrogen Phthalate ($C_8H_5O_4K$), KHP, dried to a constant weight. Thoroughly dissolve with 50-75 ml reagent water. Add 0.1 ml reagent grade concentrated phosphoric acid, and fill to the 100 ml mark with reagent water.
3. Carrier gas: Purified oxygen, carbon dioxide free and containing less than 1 ppm hydrocarbon.

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5.0 Procedure

1. Position sample boat under the septum injection port and inject standard into sample boat. Press "run" on instrument operation board and enter weight (40 ul of aqueous KHP standard is equivalent to 40 mg weight) and press "enter".
2. Slowly push boat into the combustion tube during the period "inject now" on instrument screen. When baseline is returning, remove boat from combustion tube and position under injection port.
3. When integration is completed, continue with at least two more standard injections until results are reproducible ($\pm 2\%$). Verify that the percentage error is less than $\pm 2\%$ on printout from instrument. Update calibration on instrument and verify that a new CAL factor for the syringe mode (boat inlet) is updated.
4. Soil samples should be homogenized and pulverized to allow for more efficient vaporization of the sample in the furnace.
5. Following calibration procedure, sample boat is removed and placed onto analytical balance. Balance is tared and 5- 40 mg of soil sample is transferred to boat. Sample boat is placed back into hatch port.
6. Close the hatch, and allow the detector baseline to stabilize. Press "Run", enter sample weight in mg, and press "Enter".
7. Slowly push the boat into the combustion tube during the period : Inject Now". When baseline begins returning, pull out the boat and position under the hatch port.
8. After completion of integration, press "Yes" to continue, or "No" for the next sample. The result is reported in ppm.
9. For sample spikes, chose a sample to be used for the matrix spike (MS) and matrix spike duplicate (MSD), spike one to five times the concentration of the original sample to the MS and MSD. Use the 2000 ppm KHP stock standard to prepare the spike solution. Spike the same concentration to the Blank spike (BS).
10. Analyze a method blank with every batch of samples being analyzed.

NON FILTERABLE RESIDUE (TSS) IN AQUEOUS MATRICES**1.0 Scope of Application**

- 1.1 This is a procedure for analyzing total suspended residue in water and wastewater. It is a gravimetric determination of that material retained by glass fiber filter upon filtration of an aqueous sample.
- 1.2 The practical range of the method is 4 mg/l to 20,000 mg/l.

2.0 Summary of Method

- 2.1 A well-mixed sample is filtered through a glass fiber filter, and the residue retained on the filter is dried to constant weight at 103-105°C.
- 2.2 The filtrate from this method may be used for Residue, Filterable.

3.0 Interference

- 3.1 Filtration apparatus, filter material, pre-washing, post-washing, and drying temperature are specified because these variables have been shown to affect the results.
- 3.2 Samples high in Filterable Residue (dissolved solids), such as saline waters, brines and some wastes, may be subject to a positive interference. Care must be taken in selecting the filtering apparatus so that washing of the filter and any dissolved solids in the filter (7.5) minimizes this potential interference.

4.0 Safety

- 4.1 Technician's performing this method should be familiar with the NAC Safety Manual, and the precautions stated in the EPA methodology.

5.0 Sample Collection, Preservation and Handling

- 5.1 Adhere to those procedures specified in the field procedures methods for collection, preservation and handling.

6.0 Apparatus and Materials

- 6.1 Glass fiber filter discs, 4.7 cm without organic binder, Gelman type A/E, or equivalent.
- 6.2 Filter Holder, membrane filter funnel.
- 6.3 Suction flask, 1,000 ml.
- 6.4 Drying oven, 103°.
- 6.5 Desiccator.
- 6.6 Analytical balance, capable of weighing to 0.1 mg.
- 6.7 Graduated cylinders, 100 ml.

7.0 Reagents and Standards Preparation

- 7.1 Deionized water.

8.0 Quality Control

- 8.1 With each batch of analyses run a blank.
- 8.2 For each 10 sample, perform the analysis in duplicate on a randomly selected sample.
- 8.3 Enter the duplicate data on the appropriate form in the Wet Chemistry Quality Assurance Logs.

9.0 Procedures

- 9.1 Preparation of glass fiber filter: Place the glass fiber filter on the membrane filter apparatus. While vacuum is applied, wash the disc with one 100 ml volume of distilled water. Remove all traces of water by continuing to apply vacuum after water has passed through. Remove filter from membrane filter apparatus and dry in an oven at 103-105°C for one hour. Remove to desiccator and store until needed. Weigh immediately before use. After weighing, handle the filter of crucible/filter with forceps or tongs only.

- 9.2 Assemble the filtering apparatus and begin suction. Wet the filter with a small volume of distilled water to seat it against the fritted support.
- 9.3 Shake the sample vigorously and quantitatively transfer a predetermined sample volume to the filter using a graduated cylinder. Remove all traces of water by continuing to apply vacuum after sample has through.
- 9.4 With suction on, wash the graduated cylinder, filter, non-filterable residue filter funnel wall with three portions of distilled water allowing complete drainage between washing. Remove all traces of water by continuing to apply vacuum after water has passed through.
- 9.5 Carefully remove the filter from the filter support. Alternatively, remove crucible and filter from crucible adapter. Dry at least one hour at 103-105°C. Cool in a desiccator and weigh. Repeat the drying cycle until a constant weight is obtained (weight loss is less than 0.5 mg).

10.0 Calculations:

- 10.1 Calculate non-filterable residue as follows:

$$\text{Non-filterable residue, mg/l} = \frac{(A - B) \times 1,000}{C}$$

where:

A = weight of filter + residue, in mg
B = weight of filter in mg
C = ml of sample filtered

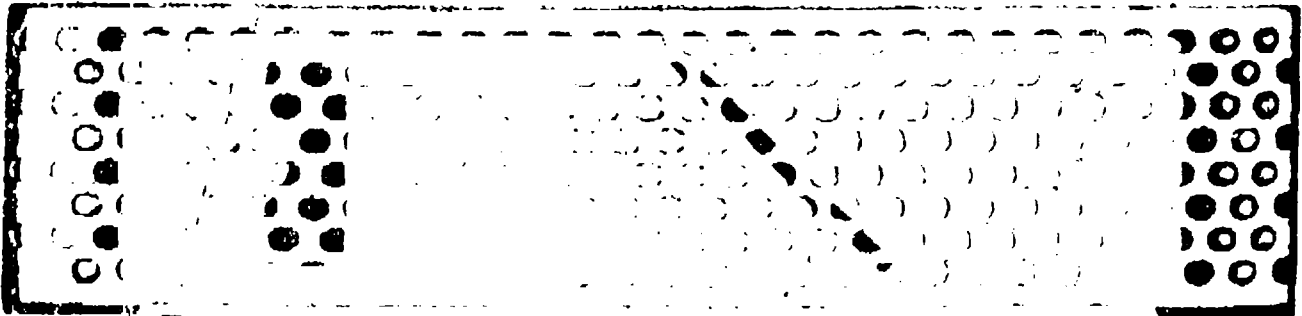
NAC/ENL: 311.01
Date: 04-20-90
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11.0 Supplemental Documents

11.1 None

12.0 References

12.1 Methods For Chemical Analysis of Water and Wastes, EPA-600 4-79-020, Method 160.2



Method: Chemical Oxygen Demand in Aqueous Matrices
Method No.: 904
Reference: EPA Methods for the Chemical Analysis of Water
and Wastes, Revised March 1983, Method 410.4.
Date: January 1988 Revision I 12/12/89

1.0 Scope and Application

- 1.1 This is a procedure for analyzing the chemical oxygen demand of water and wastewater.
- 1.2 The useful concentration range is 20 to 900 mg/l chemical oxygen demand.

2.0 Summary of Method

- 2.1 Sample, blanks and standards in sealed tubes are heated in an oven or block digester in the presence of dichromate at 150°C. After two hours, the tubes are removed from the oven or digester, cooled and measured spectrophotometrically at 600 nm.

3.0 Interferences

- 3.1 Chlorides are quantitatively oxidized by dichromate and represent a positive interference. Mercuric sulfate is added to the digestion tubes to complex the chlorides.

4.0 Apparatus and Materials

- 4.1 Drying oven or block digester, 150°C.
- 4.2 Corning culture tubes, 16 x 100 mm or 25 x 150 mm with Teflon lined screw caps containing digestion reagent.
- 4.3 Spectrophotometer.
- 4.4 Pipets, 1.0 ml and 2.0 ml.
- 4.5 Top loading balance, sensitive to 0.1 g.



Chemical Oxygen Demand in Aqueous Matrices
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5.0 Reagents

- 5.1 Potassium Acid Phthalate spike solution: Dissolve 4.251 g potassium biphthalate in 100 ml deionized water. 1 ml = 500 ug COD.

6.0 Procedure

- 6.1 Add 2.5 ml of sample to the 16 x 100 mm tubes containing the digestion reagent.
- 6.2 Cap tightly and shake to mix layers.
- 6.3 Process standards and blanks exactly as the samples.
- 6.4 Place in oven or block digester at 150°C for two hours.
- 6.5 Cool, allow any precipitate to settle and measure intensity in spectrophotometer at 600 nm. Use only optically matched culture tubes or a single cell for spectrophotometric measurement.

7.0 Calculation

- 7.1 Prepare a standard curve by plotting peak height or percent transmittance against known concentrations of standards.
- 7.2 Compute concentration of samples by comparing sample response to standard curve.



Chemical Oxygen Demand in Aqueous Matrices

Method No. 904

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8.0 Quality Assurance

- 8.1 Spike duplicates for each batch of 20 samples, a spike and a spike duplicate shall be analyzed in accordance with the following procedure:

8.1.1 Prepare a KHP Spike Solution exactly as in Para 5.1.

8.1.2 Add 1.0 ml of solution from Para 8.1.1 to 1.5 ml of sample. Prepare 2 of these spike samples. Subject these to the procedure in Para 6.0 with the rest of the samples and blank.

- 8.2 Bias Control - For each batch of 20 samples, add 2.5 ml of the solution in Para 8.1.1 to the 16 x 100 mm tubes with digestion reagent and subject this to the procedure in Para 6.0 with the rest of the samples, spikes and blanks.

- 8.3 Calculate the 2 percent recoveries in accordance with

$$\% \text{ rec'y} = \frac{[(\text{mg/l spike} \times 2.5) - (\text{mg/l sample} \times 1.5)]}{500} \times 100$$

- 8.4 Calculate the bias control recovery in accordance with

$$\% \text{ rec'y} = \frac{[(\text{mg/l} \times 2.5)]}{1,250} \times 100$$

- 8.5 Calculate the RPD in accordance with

$$\text{RPD} = \frac{|\% \text{ rec'y \#1} - \% \text{ rec'y \#2}|}{(\% \text{ rec'y \#1} + \% \text{ rec'y \#2})} \times 200$$

- 8.6 Enter the Quality Control data on the appropriate form in the Wet Chemistry Quality Assurance Logs.

Method: Chloride in Aqueous Matrices

Method No: 905

Reference: Standard Methods for the Examination of Water and Wastewater, 16th Edition, Method 407A.

Date: January 1988 Revision I 12/12/89

1.0 Scope and Application

- 1.1. This is a procedure for analyzing chloride ion in water and wastewater. It operates by the titration of chloride with silver nitrate.
- 1.2 Minimum detectable concentration is 3 mg/l chloride. High chloride samples simply require dilution.

2.0 Summary of Method

- 2.1 In neutral or slightly alkaline solution, potassium chromate can indicate the end point of the silver nitrate titration of chloride. Silver chloride is precipitated quantitatively before red silver chromate is formed.

3.0 Interferences

- 3.1 Substances in amounts normally found in potable waters will not interfere. Bromide, iodide, and cyanide register as equivalent chloride concentrations. Sulfide, thiosulfate, and sulfite ions interfere but can be removed by treatment with hydrogen peroxide. Orthophosphate in excess of 25 mg/l interferes by precipitating as silver phosphate. Iron in excess of 10 mg/l interferes by masking the end point.

4.0 Apparatus and Materials

- 4.1 Erlenmeyer flask, 250 ml.
- 4.2 Buret, 50 ml.
- 4.3 Magnetic stirrer and stir bars.
- 4.4 Pipets, 5 ml graduated.
- 4.5 Graduated cylinders 50, 100 ml.

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5.0 Reagents

- 5.1 Potassium chromate indicator solution: Dissolve 50 g K_2CrO_4 in a little distilled water. Add $AgNO_3$ solution until a definite red precipitate is formed. Let stand 12 hours, filter, and dilute to 1 liter with distilled water.
- 5.2 Standard silver nitrate titrant, 0.0141N; Dissolve 2.395 g $AgNO_3$ in distilled water and dilute to 1,000 ml. Standardize against 0.0141N NaCl, 1.00 ml = 500 ug Cl. Store in a brown bottle.
- 5.3 Standard sodium chloride, 0.0141N; Dissolve 824.0 mg NaCl (dried at 140°C) in distilled water and dilute to 1,000 ml; 1.00 ml = 500 ug Cl.
- 5.4 Special reagents for removal of interference.
 - 5.4.1 Aluminum hydroxide suspension: Dissolve 125 g aluminum potassium sulfate or aluminum ammonium sulfate, $AlK(SO_4)_2 \cdot 12H_2O$, or $AlNH_4(SO_4)_2 \cdot 12H_2O$, in 1 liter distilled water. Warm to 60°C and add 55 ml conc ammonium hydroxide (NH_4OH) slowly with stirring. Let stand about 1 hour, transfer to a large bottle, and wash precipitate by successive additions, with thorough mixing and decanting with distilled water, until free from chloride. When freshly prepared, the suspension occupies a volume of approximately 1 liter.
 - 5.4.2 Phenolphthalein indicator solution.
 - 5.4.3 Sodium hydroxide NaOH, 1N.
 - 5.4.4 Sulfuric acid, H_2SO_4 , 1N.
 - 5.4.5 Hydrogen peroxide, H_2O_2 , 30%.



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6.0 Sample Collection, Preservation and Handling

- 6.1 Adhere to those procedures specified in the field procedures methods for collection, preservation and handling.

7.0 Procedures

- 7.1 Sample preparation: Use a 100 ml sample or a suitable portion diluted to 100 ml. If the sample is highly colored, add 3 ml $\text{Al}(\text{OH})_3$ suspension, mix, let settle, and filter.
- 7.2 Titration: Directly titrate samples in the pH range 7 to 10. Adjust sample pH to 7 to 10 with H_2SO_4 or NaOH if it is not in this range. Add 1.0 ml K_2CrO_4 indicator solution. Titrate with standard AgNO_3 titrant to a pinkish yellow end point. Be consistent in end-point recognition.

Standardize AgNO_3 titrant and establish reagent blank value by the titration method outlined above. A blank of 0.2 to 0.3 ml is usual.

8.0 Calculation

$$\text{mg/l} = \frac{(A-B) \times N \times 35,450}{\text{ml of sample}}, \text{ where}$$

A = ml titration for sample

B = ml titration for blank, and

N = normality of AgNO_3



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Chloride in Aqueous Matrices

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9.0 Quality Assurance

- 9.1 Spike duplicates. For each batch of 20 samples, a spike and a spike duplicate shall be analyzed in accordance with the following procedure:

9.1.1 Prepare a separate Stock Spike Solution exactly as in Para. 5.3.

9.1.2 Add 10 ml of solution from Para 9.1.1 to 40 ml of sample. Prepare 2 of these spike samples. Subject these to the procedure in Para 7.0 with the rest of the samples.

- 9.2 Bias Control. For each batch of 20 samples, add 10 ml of the solution in Para 9.1.1 to 40 ml deionized water and subject this to the procedure in Para 7.0 with the rest of the samples and spikes.

- 9.3 Calculate the 2 percent recoveries in accordance with

$$\% \text{ rec'y} = \frac{[(\text{mg/l spike} \times 50) - (\text{mg/l sample} \times 40)]}{5,000} \times 100$$

- 9.4 Calculate the bias control in accordance with

$$\% \text{ rec'y} = \frac{[(A-B) \times N \times 35,450]}{5,000} \times 100, \text{ where}$$

A = ml titration for sample

B = ml titration for blank, and

N = normality of AgNO_3

- 9.5 Calculate the Relative Percent Difference in accordance with

$$\text{RPD} = \frac{|\% \text{ rec'y \#1} - \% \text{ rec'y \#2}|}{(\% \text{ rec'y \#1} + \% \text{ rec'y \#2})} \times 200$$

- 9.6 Enter the Quality Control Data on the appropriate form in the Wet Chemistry Quality Assurance Logs.

Method: Ammonia Nitrogen

Method No.: 906

Reference: Standard Methods for the Examination of Water and Wastewater, 16th Edition, Method 417A and 417B or 417D.

Date: January 1988 Revision I 12/12/89

1.0 Scope and Application

- 1.1 This is a procedure for analyzing Ammonia Nitrogen in water, wastewater, soils and sludge.
- 1.2 A distillation and nesslerization or titration is used.
- 1.3 The detection limit is approximately 2 mg/l when a 250 ml aliquot is used for titration.
- 1.4 The detection limit is approximately 100 ug/l when a 250 ml aliquot is used for nesslerization.

2.0 Summary of Method

- 2.1 The sample is buffered at pH 9.5 with borate buffer and distilled into a solution of indicating boric acid. The ammonia in the distillate can be determined by titration with standard sulfuric acid or by nesslerization.

3.0 Interferences

- 3.1 A procedural blank should be analyzed with the sample to check for ammonia contamination in the reagents and glassware.
- 3.2 Residual Chlorine must be removed before the ammonia determination by pre-treatment of sample.

Ammonia Nitrogen

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4.0 Apparatus and Materials

- 4.1 Heating Mantels.
- 4.2 24/40 Graham Condensers.
- 4.3 1,000 ml sidearm flask with 24/40 tip.
- 4.4 Beakers, 600 ml.
- 4.5 Buret, Class A, 50 ml.
- 4.6 Magnetic stirrer and stir bars.
- 4.7 Spectrophotometer.
- 4.8 Nessler tubes.
- 4.9 pH meter.

5.0 Reagents

- 5.1 Ammonia-free water.
- 5.2 Ammonia Spike Solution - Dissolve 3.819 g anhydrous NH_4Cl , dried at 100°C for 2 hours in ammonia free water and dilute to 1,000 ml. 1 ml = 1 mg $\text{NH}_3\text{-N}$.
- 5.3 Borate Buffer Solution - Add 88 ml 0.1N NaOH solution to 500 ml 0.025M sodium tetraborate solution (9.5 g $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ diluted to 1 liter) and dilute to 1 liter.
- 5.4 Sodium Hydroxide 6N - Dissolve 240 g NaOH in 1 liter ammonia-free water.
- 5.5 Mixed Indicator Solution - Dissolve 200 mg methyl red indicator in 100 ml 95% ethyl or isopropyl alcohol. Dissolve 100 mg methylene blue in 50 ml 95% ethyl or isopropyl alcohol. Combine the two solutions.
- 5.6 Indicating boric acid solution - Dissolve 20 g H_3BO_3 in ammonia-free water. Add 10 ml mixed indicator solution and dilute to 1 liter.



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5.0 Reagents (Continued)

- 5.7 Standard Sulfuric Acid, 0.050N - Dilute 25.0 ml of purchased 1.0N sulfuric acid to 500 ml with ammonia-free water.
- 5.8 Nessler reagent - Dissolve 100 g HgI_2 and 70 g KI in a small quantity of water and add this mixture slowly, with stirring, to a cool solution of 160 g NaOH dissolved in 500 ml water. Dilute to 1 liter. Store in rubber-stoppered borosilicate glassware and out of sunlight to maintain reagent stability for up to one year under normal laboratory conditions.

6.0 Sample Collection, Preservation and Handling

- 6.1 Adhere to those procedures specified in the field procedures method for collection, preservation and handling.

7.0 Distillation Procedure

- 7.1 Choose an aliquot and dilute up to approximately 500 mls using ammonia-free water in a 600 ml beaker. For sediment or sludge samples, rapidly weigh an aliquot, rinse into a 600 ml beaker and add approximately 500 ml of ammonia-free water.
- 7.2 Add 20 mls Borate Buffer.
- 7.3 Adjust pH to 9.5 with 6N NaOH.
- 7.4 Quantitatively transfer samples into 1,000 ml sidearm flasks and cap.
- 7.5 Place sidearm flasks into mantels and attach to condensers.
- 7.6 Submerge tips of condensers into 50 mls of indicating boric acid contained in 600 ml beaker.
- 7.7 Distill, collecting 200 to 300 ml distillate.



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8.0 Ammonia Measurement

- 8.1 Titrate the ammonia in the distillate with standard 0.05N H_2SO_4 until indicator color reaches color of blank.
- 8.2 If low level ammonia is to be determined, then proceed from 7.7 directly to 8.2.1.
 - 8.2.1 Distill reagent blank and appropriate standards in the same manner as the samples.
 - 8.2.2 Add 1 ml of nessler reagent to 50 ml portions of the distilled samples, blanks, and standards, mixing well.
 - 8.2.3 Measure absorbance or transmittance with a spectrophotometer.
 - 8.2.4 Measure transmittance readings against a reagent blank.

9.0 Calculation

- 9.1 For ammonia determination by titration, calculate as follows:

$$\text{mg/l ammonia N} = \frac{(A-B) \times N \times 14,000}{\text{ml sample}}, \text{ where}$$

A = ml H_2SO_4 titration for sample

B = ml H_2SO_4 titration for blank

N = N of H_2SO_4

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9.0 Calculation (Continued)

9.2 For ammonia determination by nesslerization, calculate as follows:

mg/l ammonia-N (51 ml final volume)

$$= \frac{A}{\text{ml sample}} \times \frac{B}{C}, \text{ where}$$

A = ug NH₃-N (51 ml final volume)

B = total volume distillate collected, ml,
including acid absorbent, and

C = volume distillate taken for nesslerization,
ml.

10.0 Quality Assurance

10.1 Spike duplicates - For each batch of 20 samples, a spike and a spike duplicate shall be analyzed in accordance with the following procedure:

10.1.1 Add 5.0 ml of solution from Para 5.2 to an aliquot of sample. Prepare 2 of these spike samples. Subject these to the procedure in Para 7 with the rest of the samples and blank.

10.2 Bias Control - For each batch of samples, add 5.0 ml of the solution in Para 5.2 to 495 ml deionized water and subject this to the procedure in Para 7 with the rest of the samples, spikes and blank.



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Ammonia Nitrogen

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10.0 Quality Assurance (Continued)

10.3 For titration analyses, calculate the 2 percent recoveries in accordance with:

% rec'y =

$$\frac{[(A-B) \times N \times 14,000] \text{spike} - (\text{mg/l sample} \times \text{ml sample})}{5,000} \times 100, \text{ where}$$

A = ml H_2SO_4 titration for sample

B = ml H_2SO_4 titration for blank

N = N of H_2SO_4

10.4 For nesslerization analyses, calculate the 2 percent recoveries in accordance with:

$$\frac{[(\frac{A}{\text{ml sample}} \times B) \text{ spike} - (\text{ug/ml sample} \times \text{ml sample})]}{5,000} \times 100, \text{ where:}$$

A = ug $\text{NH}_3\text{-N}$ (51 ml final volume), and

B = total volume distillate collected, ml,
including acid absorbent.

10.5 Calculate the RPD in accordance with:

$$\text{RPD} = \frac{|\% \text{ rec'y \#1} - \% \text{ rec'y \#2}|}{(\% \text{ rec'y \#1} + \% \text{ rec'y \#2})} \times 200$$

10.6 Enter the Quality Control data on the appropriate form in the Wet Chemistry Quality Assurance Logs.

ATTACHMENT 4

SAMPLING AND ANALYSIS PLAN
REMEDIAL DESIGN/REMEDIAL ACTION
MONITORING AND ADDITIONAL STUDIES
MARION (BRAGG) LANDFILL
Marion, Indiana

May 1990

Prepared for:

Marion (Bragg) Group

Prepared by:

Environmental Resources Management, Inc.
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File 448-09-01-01

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Appendix 1 - SOPs for Ground Water, Surface Water and Sediment Sampling

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SECTION 1

INTRODUCTION

This sampling and analysis plan has been prepared in accordance with general EPA guidance and as requested in the Consent Decree for the Marion (Bragg) Landfill.

Site hydrogeology, description, site history, present site conditions, and details of the selected remedy are covered in Section 1 of the QAPP.

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SECTION 2

SAMPLE LOCATIONS AND ACQUISITION

The purpose of this section is to identify the locations where samples will be obtained, and to outline the sampling procedures to be used in order to effectively monitor the ground water, and to determine existing surface water, and creek and river sediment quality in the vicinity of the landfill. Standard Operating Procedures (SOPs) for collecting the ground water, surface water and sediment samples are included as Appendix 1 to this Sampling and Analysis Plan. Specific procedures for the bioaccumulation study are not included in this section because it is considered to be part of a future study which will occur only if the initial sampling efforts dictate its need; it is not part of the immediate sampling plan. The decision methodology for such an investigation, along with other future studies, are provided in the RAP and this Sampling and Analysis Plan.

2.1 Subsurface Soil Sampling

Collection of soil samples, including how the samples are collected, and how containers are filled will be according to ASTM D-1586.

The RAP addresses collection of soil samples from the monitoring well borings. Split spoon soil samples will be collected every 2-1/2 feet of the boring, and as per ASTM D-1586. Each sample will be visually classified according to the Unified Soil Classification System, and placed in an appropriate container for future reference. Chemical analysis will not be performed on these soil samples.

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2.2 Ground Water Sampling

Collection of ground water samples, including how the samples are collected, how containers are filled, and procedures for the collection/preparation of blanks and duplicates will be according to the Ground Water Sampling SOP included in Appendix 1 of this plan. A description of the sampling locations and procedures is provided below.

2.2.1 Sample Locations

The proposed locations of ten new monitoring wells (Figure 2-1) were selected with consideration of the following factors:

- o The wells should not be installed through buried waste.
- o The geology of the site can be assumed to be relatively simple, with a relatively homogeneous upper aquifer.
- o The upper aquifer discharges into the Mississinewa River.

Shallow aquifer monitoring wells MB-1 through MB-8 will be installed at locations on the landfill property which are downgradient from areas of waste deposition, and upgradient from the Mississinewa River. These wells, close to the river and outside of the landfill wastes, will provide a more accurate indication of the quality of ground water which is discharging to the river. In addition, these wells will help to monitor the potential influence of surface water quality on the quality of ground water beneath the site, which is a common occurrence in river flood plains during periods of high water and gradient reversal.

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Two additional shallow aquifer wells, MB-9 and MB-10, will be installed upgradient from the facility to provide information regarding the quality of ground water entering the site, to act as background data.

All of the proposed monitoring wells are to be completed in the shallow aquifer; however, as shown on the ground water sampling location map (Figure 2-1), four of the wells are to be in the deeper zone of the aquifer, just above the contact with the underlying till confining layer. This contact is estimated to be approximately 30-50 feet below the surface, according to drilling logs of the existing monitoring wells. The remaining six wells are to be screened in the shallower zone of the shallow aquifer. The screens for these wells will extend above the normal water table. This combination of well depths will enable data to be obtained regarding compounds throughout the depth of the shallow aquifer without the use of a long screened interval. The specific depths of the wells will be determined depending on conditions encountered as the borings are drilled.

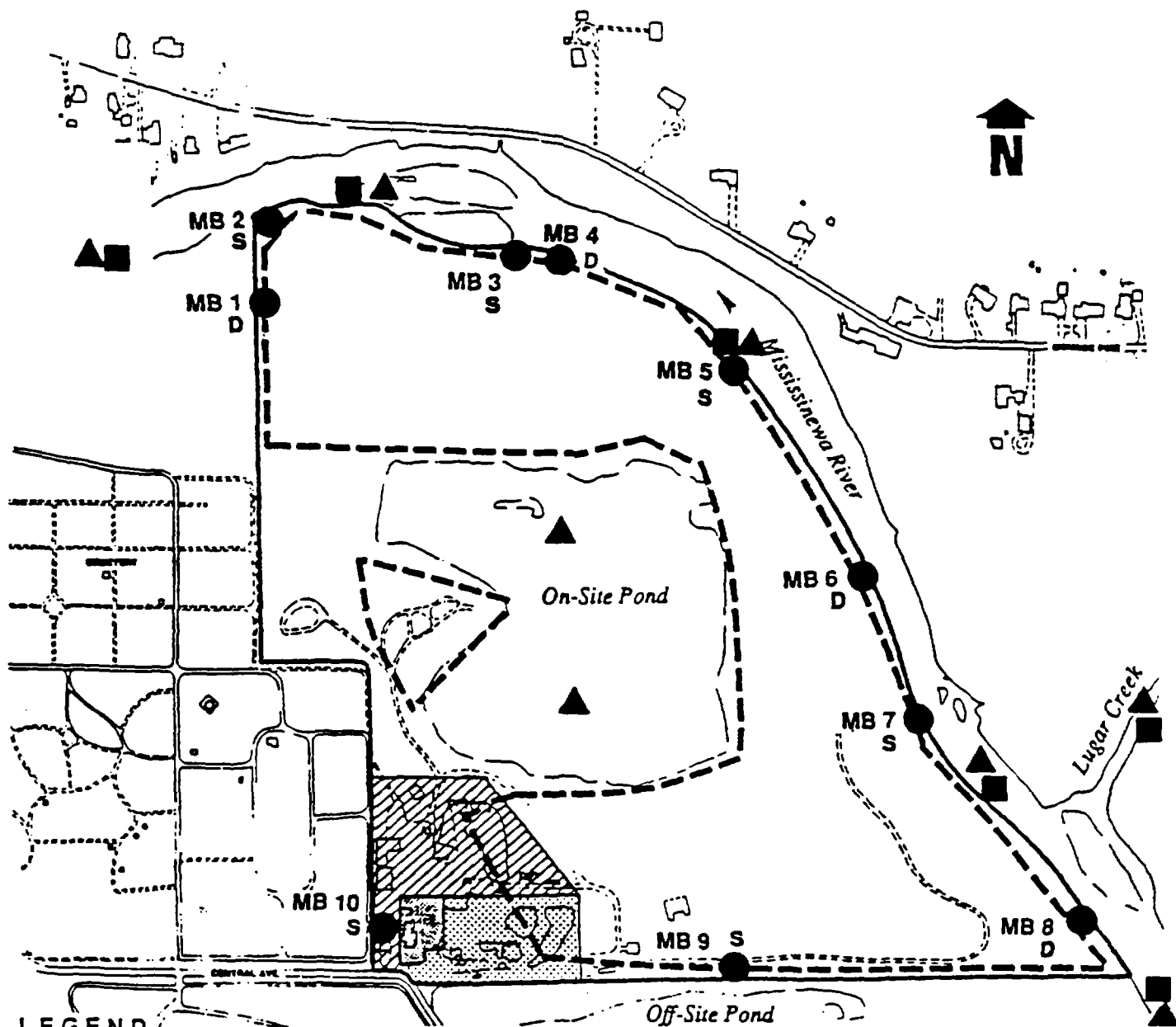
2.2.2 Preparation for Sampling

Preparation for ground water sampling will include the acquisition of all necessary monitoring equipment and site-specific information to perform the required monitoring. Prior to initiating any sampling activities, a complete round of depth to water levels will be measured to the nearest one hundredth of a foot.

Monitoring wells are to be evacuated and sampled proceeding from the suspected least to most contaminated well to minimize potential cross-contamination. The sampling order of the wells from least to most contaminated will initially be based on ground water flow directions and well location with respect to the landfill. Total well depths necessary to calculate the required purge volumes will be tabulated after the completion of the new well installations.

Figure 2-1 Proposed Sampling Locations Marion (Bragg) Landfill

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LEGEND

- Site Boundary
- /// Marion Paving Co., Inc.
- ▨ Dobson Construction Co., Inc.
- Private Residence
- - - Landfill Area
- ▲ Proposed Surface Water Sampling Locations
- Proposed Ground Water Sampling Location
S - Shallow Zone of Upper Aquifer
D - Deeper Zone of Upper Aquifer
- Proposed Sediment Sampling Location

0 250 500
Scale in Feet

Source: U.S. EPA 1987.

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2.2.3 Well Evacuation

Monitoring wells will be evacuated of three volumes of water standing in the well casing, or until the well goes dry prior to sample acquisition. Purge volumes will be calculated according to Table 2-1, which gives well volumes per foot of depth for various casing diameters.

A stainless steel body ISCO Model 2600 bladder pump, Waterra pump, or stainless steel body Fultz pump with polyethylene tubing will be used to evacuate all accessible two-inch monitoring wells. Pump placement depths will be dependent on well yields. Small diameter pump flow rates are typically low (< 1.5 gpm), necessitating placement of the pump intake at the top of the water column in high yielding wells. Low well yields require pump placement to be at the bottom of the well. Proper pump placement will insure complete and proper evacuation. Upon completion of the required purge volume, non-dedicated pumping systems will be removed from the well. Wells that are inaccessible with the pump system will be hand bailed using a bottom-loading teflon bailer.

Purged water will be collected, stored in 55 gallon drums at the site and discharged to an appropriate location once ground water analyses have been performed. The U.S. EPA and IDEM will be contacted prior to disposal of the purged water. Once ground water from a given well has been analysed and the appropriate discharge location has been determined, water purged during subsequent events will be discharged to the same location, without additional analyses.

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TABLE 2-1
Volume of Water in Casing

<u>Inner Diameter of Casing (in.)</u>	<u>Gallons Per Foot of Depth</u>
1.0	0.041
1.5	0.092
2.0	0.163
2.5	0.255
3.0	0.367
3.5	0.500
4.0	0.653
4.5	0.826
5.0	1.020
5.5	1.234
6.0	1.469
7.0	2.000
8.0	2.611

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2.2.4 Sample Acquisition

Ground water pH, temperature, and conductivity will be measured immediately after purging; samples will not be collected until pH stabilizes to +/- 10% over three consecutive readings.

Dedicated one and one-quarter (1-1/4) inch, bottom-loading teflon bailers or Waterra Pumps will be used to collect grab, ground water samples for transfer into the proper sample containers. Monofilament polypropylene will be used to raise and lower the bailer. If well yields are low at the site, the samples will be collected as the well recovers and provides a sufficient volume for sample collection.

2.3 Surface Water Sampling

Collection of surface water samples, including how the samples are collected, how containers are filled, and procedures for the collection/preparation of blanks and duplicates will be according to the Surface Water Sampling SOP included in Appendix 1 of this plan. A description of the sampling locations and procedures is provided below.

2.3.1 Sample Locations

Samples of surface water will be collected from the on-site pond, the off-site pond, the Mississinewa River, and Lugar Creek (Figure 2-1). Sampling points on the river will be located at three areas adjacent to the landfill site, downstream at one location, and upstream at one location to serve as background data. One sampling point will be located along Lugar Creek, two will be from the on-site pond, and two more will be from the off-site pond.

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The Mississinewa River and Lugar Creek surface water sampling will begin at the farthest downstream location and proceed to upstream locations to minimize potential cross-contamination from suspended material in the stream from sampling activities. The Mississinewa River sampling locations will be positioned between mid-river and the left shore (facing downstream) to reflect conditions associated with the landfill. The Lugar Creek sampling location will be at the mid-channel position of the creek.

2.3.2 Sample Acquisition

Dependent upon depth and stream velocity, samples from the river and creek will be either collected directly into the appropriate sample containers, upstream from the position of the sampler, or through the use of a long-handled polyethylene grab sampler from the bank of the stream. Samples will be collected at a depth of six inches below the water surface.

The on-site and off-site pond surface water samples will be collected at the designated sampling locations. A deep sample (within 3 feet of the pond bottom) and a shallow sample (6 inches below the water surface) will be collected from each pond. A stainless steel Kemmerer-type sampler will be used to collect the deep samples from the appropriate depth for transfer to the sample containers. The shallow samples will be collected directly into the appropriate sample containers.

2.4 River and Creek Sediment Sampling

Collection of sediment samples, including how the samples are collected, how containers are filled, procedures for the collection/preparation of blanks and duplicates, and decontamination procedures, will be according to the Sediment Sampling SOP included in Appendix 1 of this plan. A description of the sampling location and procedures is provided below.

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2.4.1 Sample Locations

Fine grain sediment samples will be collected in the general vicinity of the surface water sampling locations in the Mississinewa River and Lugar Creek (Figure 2-1). The sediment samples will be collected from location between mid-river and the left shore (facing downstream) to reflect any "sideness", or conditions associated with the landfill.

2.4.2 Sample Acquisition

A stainless steel Eckman-type dredge sampler or a sediment core sampler will be used to collect the samples from the upper six inches of sediment. The sediment will then be transferred to the appropriate sample containers using a stainless steel spatula.

2.5 Sampling Frequency and Analysis

Sampling frequency and analysis is covered in Section 1, Table 1-1 of the QAPP.

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SECTION 3

DECONTAMINATION PROCEDURES

3.1 Drilling Equipment Decontamination

Drilling equipment will be decontaminated prior to initial use, between boring locations, and at the completion of drilling activities. Items necessary to decontaminate include, but are not limited to the following items:

- back of drilling rig.
- auger flights, and
- down-hole equipment

A manual scrubbing to remove foreign material followed by a thorough steam cleaning will be used for decontamination of the drilling equipment. Drilling equipment will be stored in a contaminant-free location after decontamination.

Once the drilling rig enters the exclusion zone, the wheels, wheel wells and under carriage will also be thoroughly decontaminated prior to departure from the zone.

3.2 Sampling Equipment Decontamination

All non-disposable equipment (bailers, split spoon samplers, hand trowels, etc.) will be decontaminated prior to each use according to the following procedures:

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- Manual scrub with a non-phosphate soap solution.
- Rinse with tap water.
- Rinse with a 10% nitric acid solution (only if to be analysed for metals).
- Rinse with reagent grade methanol.
- Rinse thoroughly with deionized water.
- Allow apparatus to air dry.

Each dedicated bailer will be individually wrapped in a plastic trash bag and sealed following decontamination, and stored at a secured, contaminant-free location. All water and chemicals used for decontamination procedures will be collected and stored in 55 gallon drums. The U.S. EPA and IDEM will be contacted prior to the disposal of the decontamination fluids.

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SECTION 4

DOCUMENTATION OF SAMPLING PROCEDURES

The documentation of sample collection will include the use of bound field log books in which all information relating to sample collection will be entered in indelible ink. Appropriate information will be entered to reconstruct the sampling event, including: site name (top of each page), sample identification, sampling methodology, field measurements and observation, and sampler's initials (dated, at the bottom of each page). An example field notebook SOP is provided in Figure 4-1. The SOP is copied and attached to all field notebooks issued to site personnel.

Sample documentation, labelling and associated forms are further covered in Section 5.2.1 (Sample Packing, Handling and Shipment) of the QAPP.

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FIGURE 4-1 **SOP SAMPLING LOGBOOKS**

One or more bound books will be maintained for each site; the book(s) will remain with the site evidence file. Copies should be made for the person who made the entries and the project manager if requested.

All entries in the Logbook must be made in ink.

First Page should contain:

- o Site name and number
- o Date and time started
- o Personnel on site

Next page(s) Depth to Water (DTW) for all wells if required by the sampling plan. Also serial number of the DTW meter.

Each new day should contain:

- o Date and time started
- o Weather
- o Personnel on site
- o Sampling information (see next section)

Note when a mistake is made in the Log, put a single line through it in ink and initial and date.

SAMPLE INFORMATION

- o Sample Number (Traffic Report)
- o Date and Time Sample collected
- o Source of Sample (well, stream, domestic well, field etc.)
- o Purged Well - type of equipment, purge volume, rate of purge, and decontamination procedures

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FIGURE 4-1 (continued)
SAMPLE INFORMATION

- o Location of Sample - document with a site sketch and/or written description (where sample was taken so that it could be found again).
- o How was sample taken? (bailer, trowel, SS spoon, thief, etc.)
- o Analysis and QA/QC required (601, 602, Metals, Tier I, Tier II, etc.)
- o Chemical Preservation used (HNO_3 , H_2SO_4 , NaOH , etc.)
- o Field Data (pH, DO, spec. and temp., etc.)
- o Field Observations - significant observations should be documented.
 - Sample condition (color, odor, turbidity, oil, sheen)
 - Site condition (stressed vegetation, exposure of buried wastes, erosion problems, etc.)
- o How sample was shipped, date, time and where to, and if legal seals were attached to transport container(s).
- o Comments - Any observation or event that occurred that would be relevant to the site; for example, weather changes or effect it had on sampling, conversations with the client, public official or private citizen; instrument calibration, equipment problems, etc.

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SECTION 5

FUTURE STUDIES

The need for sampling and analysis beyond that discussed in the previous section of this sampling and analysis plan will be evaluated based on two separate decision trees. One of the decision trees is directed towards bioaccumulation studies, while the second decision tree covers additional water quality studies and biological survey. Each of the decision methodologies are provided in the RAP. If these future studies are necessary, an Addendum Sampling and Analysis Plan with an Addendum QAPP will be provided.

APPENDIX 1

SOPs FOR GROUND WATER, SURFACE WATER AND SEDIMENT SAMPLING

**GROUND WATER SAMPLING
STANDARD OPERATING PROCEDURE
MARION (BRAGG) LANDFILL**

Prior to initiating any activities associated with the ground water sampling, all personnel should review the requirements of the Marion (Bragg) Landfill QAPP, Sampling and Analysis Plan, and Ground Water Monitoring Plan. Copies of these documents are to be available on-site for reference during the monitoring event. Ground water samples will be collected from ten monitoring wells, MB-1 through MB-10, as located on Figure 2-1 of the Sampling and Analysis Plan. Each ground water sample will be analyzed for the constituents listed on Table 1-1 of the QAPP.

1.0 Presampling Activities

- 1.1 Review all appropriate Plans referenced above. Proper health and safety procedures must be followed during sampling activities as described in the Health and Safety Plan. Obtain all necessary sampling equipment required to complete this sampling. Test all equipment before entering the field.
- 1.2 Locate all monitoring wells at the site and inspect for any possible damage. Note any problems in the site dedicated Field Log Book (FLB).
- 1.3 Measure the depth-to-water of each monitoring well to the nearest 1/100th of a foot using an electronic water level indicator. A permanent mark should exist on the top of the well casing where the elevation was surveyed. Record the depth-to-water in the FLB along with the total depth of the well. Decontaminate the water level indicator between use as per Section 3.2 of the Sampling and Analysis Plan.
- 1.4 Calculate the volume of water (gallons) in each well based on the total well depth, depth-to-water measurement, and inside well casing diameter (use the conversion factor in Table 2-1 of the Sampling and Analysis Plan).

Multiply this volume by three (3) to get the required well evacuation volume.

2.0 Well Evacuation

- 2.1 Clean plastic sheeting will be placed on the ground surface adjacent to the well. Equipment and supplies to be used for sampling will be stored on the plastic sheeting.
- 2.2 A minimum of three times the volume (calculated in 1.4) of water standing in the well will be removed with a small diameter pump fitted with polyethylene tubing. The well will be evacuated until pH, temperature and conductivity measurements stabilizes to +/- 10% over three consecutive readings. If the well can not sustain a yield, it will be purged to dryness. The volume of water evacuated will be measured in a bucket of known volume. Record all field measurements in the FLB.

The pump placement depth will be dependent on well yield. High yielding wells necessitates placement of the pump at the top of the water column. Low yielding wells require pump placement to be at the bottom of the well. Proper pump placement will insure complete and proper evacuation. Information on well yield should be recorded in the FLB for use in subsequent monitoring rounds. Observations on physical appearance and odor should also be recorded in the FLB during well evacuation.

- 2.3 After the well has been evacuated, remove the pump system from the well. Thoroughly decontaminate the pump system by purging first potable water followed by deionized water through the pump. Decontaminate the outside of the pump system with potable then deionized water using a hand held pressure sprayer. A steam cleaner may also be used, if available.

3.0 Sample Acquisition

- 3.1** Secure all sample containers necessary for the analyses indicated on Table 1-1 of the QAPP and store on the plastic sheeting. Make sure all necessary preservatives are present and added to the bottles.
- 3.2** Label all bottles and fill out the necessary chain of custody as described in Section 5 of the QAPP.
- 3.3** Dedicated one and one-quarter (1-1/4) inch, bottom-loading teflon bailers or Waterra pumps will be used to collect the ground water samples for transfer into the sample containers. Monofilament polypropylene will be used to raise and lower the bailer. The initial volume of water collected in the bailer will be discarded to rinse to bailer.
- 3.4** The bailer will be refilled for sampling. The sample containers will then be filled in the following order: TCL VOCs, TCL semi-volatiles, TAL inorganics, and then the IDEM parameters.
 - 3.4.1** The sample for TAL metals will first be immediately filtered in the field through 0.45 μ m pore size filters before transfer to the sample container. Decontaminate the filtering apparatus as described in Section 3.2 of the Sampling and Analysis Plan.
- 3.5** Chemical preservation of the samples will be checked using sterile, disposable pipets to withdraw a sample aliquot and pH paper. Adjustments will be made as necessary.
- 3.6** Samples will be placed immediately into insulated coolers and packed for overnight shipment to the laboratory as described in Section 5 of the QAPP.
- 3.7** Bailers will be decontaminated according to the procedures described in Section 3.2 of the Sampling and Analysis Plan.

4.0 Field Measurements

- 4.1 Calibrate the pH, DO, and conductivity meters according to the specific manufacturers instructions and Section 6 of the QAPP. Record all instrument serial numbers, calibration information and standard sources in the FLB.
- 4.2 After samples have been procured for chemical analysis, a clean glass beaker will be filled to measure pH, DO, T, and conductivity.
- 4.3 Measure the temperature of the sample with a mercury filled Celsius thermometer. Record in the FLB.
- 4.4 Measure pH with a glass hydrogen-ion electrode by means of the calibrated pH meter. Adjust the meter for temperature as determined above. The probe will be lowered into the sample and gently stirred to allow equilibration before the reading is taken. Record the result in the FLB.
- 4.5 DO and conductivity will be measured by placing the probe into the sample and the reading immediately taken. Record the results in the FLB.
- 4.6 Each measurement probe will be rinsed initially and between use with a stream of deionized water.

5.0 Quality Control Samples

- 5.1 Trip Blanks originating from the laboratory will be submitted for analysis of TCL VOCs each day of sampling. Trip blanks will be placed inside the cooler containing the samples for VOC analysis. These blanks are not to be opened.
- 5.2 Field Blanks will be collected once per 10 investigative samples. They will consist of laboratory supplied deionized water poured through a decontaminated bailer. The Field Blank will be analyzed for identical analyses as the ground water samples.

- 5.3 Field Duplicate samples will be collected once per ten investigative samples. The duplicate sample will be collected by filling a second set of sample containers after completing the initial ground water sample. The duplicate sample should be given a fictitious identification so it is "blind" to the laboratory. The location of duplicate samples should be determined by the Quality Assurance Manager.
- 5.4 Triplicate volume of sample must be provided at the frequency of once in every twenty investigative samples so that the laboratory can perform matrix spike and matrix spike duplicate analyses. At the location specified by the Quality Assurance Manager, collect three sets of sample bottles and indicate on the traffic report form that this extra sample volume is to be used for matrix spike and matrix spike duplicate analyses.

**SEDIMENT SAMPLING
STANDARD OPERATING PROCEDURE
MARION (BRAGG) LANDFILL**

Prior to initiating any activities associated with the sediment sampling, all personnel should review the requirements of the Marion (Bragg) Landfill QAPP, and Sampling and Analysis Plan. Copies of these documents are to be available on-site for reference during the monitoring event. Sediment samples will be collected from five locations on the Mississinewa River, and one location on Lugar Creek. Sample locations correspond to the surface water sampling locations and are provided on Figure 2-1 of the Sampling and Analysis Plan. Each surface water sample will be analyzed for the constituents listed on Table 1-1 of the QAPP.

The sediment sampling will be conducted at the time of the initial surface water sampling event.

1.0 Presampling Activities

- 1.1 Review all appropriate Plans referenced above. Proper health and safety procedures must be followed during sampling activities as described in the Health and Safety Plan. Obtain all necessary sampling equipment required to complete this sampling. Test all equipment before entering the field.
- 1.2 During the initial surface water monitoring event, all exact sampling locations will be permanently staked and identified for subsequent monitoring events. This task should be completed by the Project Manager during a reconnaissance of the surface water bodies. The sediment sample locations will coincide with the Mississinewa River and Lugar Creek surface water locations.

2.0 Sample Acquisition

- 2.1** Clean plastic sheeting will be placed on the ground surface adjacent to sampling station. Equipment and supplies to be used for sampling will be stored on the plastic sheeting.
- 2.2** Sampling will proceed from the farthest downstream location and proceed to upstream locations to minimize potential cross-contamination from suspended material in the water body from sampling activities.
- 2.3** The Mississinewa River sampling locations will be positioned between mid-river and the left shore (facing downstream) to reflect conditions associated with the landfill.
- 2.4** The Lugar Creek sampling location will be at the mid-channel position of the creek, upstream from its confluence with the Mississinewa River.
- 2.5** Describe the channel conditions (depth, width, configuration and flow velocity) at each sampling location and record all observations in the Field Log Book (FLB).
- 2.6** Secure all sample containers necessary for the analyses indicated on Table 1-1 of the QAPP and store on the plastic sheeting. No chemical preservatives are needed for the sediment samples.
- 2.7** Label all bottles and fill out the necessary chain of custody as described in Section 5 of the QAPP.
- 2.8** Samples will be collected using a stainless steel Eckman dredge sampler or a sediment core sampler. Both equipment devices will be tested at a location other than a sampling location to determine which device is better suited.
- 2.9** Sediment samples will be collected upstream from the position of the sampler to a depth of six inches below the sediment surface. After the

sample is brought to the surface, it will be transferred to the sample containers using a stainless steel spatula.

- 2.10 The sample containers will then be filled in the following order: TCL VOCs, TCL semivolatiles, TAL inorganics, TOC, and grain size.
- 2.11 Samples will be placed immediately into insulated coolers and packed for overnight shipment to the laboratory as described in Section 5 of the QAPP.
- 2.13 The sediment sampling device will be decontaminated according to the procedures described in Section 3.2 of the Sampling and Analysis Plan.

3.0 Quality Control Samples

- 3.1 Trip Blanks originating from the laboratory will be submitted for analysis of TCL VOCs each day of sampling. Trip blanks will be placed inside the cooler containing the samples for VOC analysis. These blanks are not to be opened.
- 3.2 Field Blanks will be collected once per 10 investigative samples. They will consist of laboratory supplied deionized water poured through the decontaminated sediment sampler. The Field Blank will be analyzed for identical analyses as the sediment samples, with the exception of grain size.
- 3.3 Field Duplicate samples will be collected once per ten investigative samples. The duplicate sample will be collected by filling a second set of sample containers after completing the initial sediment sample. The duplicate sample should be given a fictitious identification so it is "blind" to the laboratory. The location of duplicate samples should be determined by the Quality Assurance Manager.
- 3.4 One sample in every twenty investigative samples must be identified to the laboratory to be used for matrix spike and matrix spike duplicate

analyses. Triplicate volume for the sediment samples is not necessary as sufficient sample volume is already provided. The Quality Assurance Manager will determine the location to be used for spike analyses.

**SURFACE WATER SAMPLING
STANDARD OPERATING PROCEDURE
MARION (BRAGG) LANDFILL**

Prior to initiating any activities associated with the surface water sampling, all personnel should review the requirements of the Marion (Bragg) Landfill QAPP, and Sampling and Analysis Plan. Copies of these documents are to be available on-site for reference during the monitoring event. Surface water samples will be collected from five locations on the Mississinewa River, one location on Lugar Creek, two locations from the on-site pond and two locations from the off-site pond. Sample locations are provided on Figure 2-1 of the Sampling and Analysis Plan. Each surface water sample will be analyzed for the constituents listed on Table 1-1 of the QAPP.

1.0 Presampling Activities

- 1.1 Review all appropriate Plans referenced above. Proper health and safety procedures must be followed during sampling activities as described in the Health and Safety Plan. Obtain all necessary sampling equipment required to complete this sampling. Test all equipment before entering the field.
- 1.2 During the initial monitoring event, all exact sampling locations will be permanently staked and identified for subsequent monitoring events. This task should be completed by the Project Manager during a reconnaissance of the surface water bodies. A sketch map of each location detailing site features will be prepared to allow the sampling point to be easily found.

2.0 Sample Acquisition - Mississinewa River and Lugar Creek

- 2.1 Clean plastic sheeting will be placed on the ground surface adjacent to sampling station. Equipment and supplies to be used for sampling will be stored on the plastic sheeting.
- 2.2 Sampling will proceed from the farthest downstream location and proceed to upstream locations to minimize potential cross-contamination from suspended material in the water body from sampling activities.
- 2.3 The Mississinewa River sampling locations will be positioned between mid-river and the left shore (facing downstream) to reflect conditions associated with the landfill.
- 2.4 The Lugar Creek sampling location will be at the mid-channel position of the creek, upstream from its confluence with the Mississinewa River.
- 2.5 Describe the channel conditions (estimate the depth, width, flow velocity and describe channel configuration) at each sampling location and record all observations in the Field Log Book (FLB).
- 2.6 Secure all sample containers necessary for the analyses indicated on Table 1-1 of the QAPP and store on the plastic sheeting. Make sure all necessary preservatives are present and added to the bottles.
- 2.7 Label all bottles and fill out the necessary chain of custody as described in Section 5 of the QAPP.
- 2.8 Dependent upon the depth and stream velocity at the time of sampling, collect the river or creek sample directly into the sample containers or use a long-handled polyethylene grab sampler from the bank. All attempts should be made to use a consistent method of procurement, but seasonal and safety conditions must be taken into account. Record the method used in the FLB.
- 2.9 Samples will be collected upstream from the position of the sampler at a depth of six inches below the water surface.

2.10 The sample containers will then be filled in the following order: TCL VOCs, TCL semivolatiles, TAL inorganics, and then the IDEM parameters.

2.10.1 Samples will be collected for both total and dissolved (filtered) TAL metals. The dissolved sample for TAL metals will be immediately filtered in the field through a 0.45 μm pore size filters before transfer to the sample container. Decontaminate the filtering apparatus as described in Section 3.2 of the Sampling and Analysis Plan.

2.11 Chemical preservation of the samples will be checked using sterile, disposable pipets to withdraw a sample aliquot and pH paper. Adjustments will be made as necessary.

2.12 Samples will be placed immediately into insulated coolers and packed for overnight shipment to the laboratory as described in Section 5 of the QAPP.

2.13 The grab sampler, if used, will be decontaminated according to the procedures described in Section 3.2 of the Sampling and Analysis Plan.

3.0 Sample Acquisition - On-Site and Off-Site Pond

3.1 A boat may be necessary to secure the samples. This will be determined during the initial monitoring event.

3.2 Clean plastic sheeting will be placed on the ground surface adjacent to sampling station or on the floor of the boat. Equipment and supplies to be used for sampling will be stored on the plastic sheeting.

3.3 Determine the total depth in feet to the pond bottom at the sampling location using a steel tape. Record this depth in the FLB.

- 3.4 Secure all sample containers necessary for the analyses indicated on Table 1-1 of the QAPP and store on the plastic sheeting. Make sure all necessary preservatives are present and added to the bottles.
- 3.5 Label all bottles and fill out the necessary chain of custody as described in Section 5 of the QAPP.
- 3.6 The deep sample will be collected within 3 feet on the pond bottom using a stainless-steel Kemmerer-type sampler. The shallow sample will be collected directly into the appropriate sample containers at a depth of 6 inches below the water surface.
- 3.7 Samples will be collected proceeding from the outflow location to the inflow location.
- 3.8 The sample containers will then be filled in the following order: TCL VOCs, TCL semivolatiles, TAL inorganics, and then the IDEM parameters.
 - 3.8.1 Samples will be collected for both total and dissolved (filtered) TAL metals. The dissolved sample for TAL metals will be immediately filtered in the field through a 0.45 μm pore size filters before transfer to the sample container. Decontaminate the filtering apparatus as described in Section 3.2 of the Sampling and Analysis Plan.
- 3.9 Chemical preservation of the samples will be checked using sterile, disposable pipets to withdraw a sample aliquot and pH paper. Adjustments will be made as necessary.
- 3.10 Samples will be placed immediately into insulated coolers and packed for overnight shipment to the laboratory as described in Section 5 of the QAPP.

- 3.11 The Kemmerer sampler will be decontaminated according to the procedures described in Section 3.2 of the Sampling and Analysis Plan.

4.0 Field Measurements

- 4.1 Calibrate the pH, DO, and conductivity meters according to the specific manufacturers instructions and Section 6 of the QAPP. Record all instrument serial numbers, calibration information and standard sources in the FLB.
- 4.2 After samples have been procured for chemical analysis, a clean glass beaker will be filled to measure pH, DO, T, and conductivity. If possible collect these measurements in situ.
- 4.3 Measure the temperature of the sample with a mercury filled Celsius thermometer. Record in the FLB.
- 4.4 Measure pH with a glass hydrogen-ion electrode by means of the calibrated pH meter. Adjust the meter for temperature as determined above. The probe will be lowered into the sample and gently stirred to allow equilibration before the reading is taken. Record the result in the FLB.
- 4.5 DO and conductivity will be measured by placing the probe into the sample and the reading immediately taken. Record the results in the FLB.
- 4.6 Each measurement probe will be rinsed initially and between use with a stream of deionized water.

5.0 Quality Control Samples

- 5.1 Trip Blanks originating from the laboratory will be submitted for analysis of TCL VOCs each day of sampling. Trip blanks will be placed inside the cooler containing the samples for VOC analysis. These blanks are not to be opened.

- 5.2 Field Blanks will be collected once per 10 investigative samples. They will consist of laboratory supplied deionized water poured through a decontaminated Kemmerer sampler. The Field Blank will be analyzed for identical analyses as the surface water samples.
- 5.3 Field Duplicate samples will be collected once per ten investigative samples. The duplicate sample will be collected by filling a second set of sample containers after completing the initial surface water sample. The duplicate sample should be given a fictitious identification so it is "blind" to the laboratory. The location of duplicate samples should be determined by the Quality Assurance Manager.
- 5.4 Triplicate volume of sample must be provided at the frequency of once in every twenty investigative samples so that the laboratory can perform matrix spike and matrix spike duplicate analyses. At the location specified by the Quality Assurance Manager, collect three sets of sample bottles and indicate on the traffic report form that this extra sample volume is to be used for matrix spike and matrix spike duplicate analyses.

ATTACHMENT 5

GROUND WATER MONITORING PLAN
REMEDIAL DESIGN/REMEDIAL ACTION
MONITORING AND ADDITIONAL STUDIES
MARION (BRAGG) LANDFILL
Marion, Indiana

May 1990

Prepared for:

Marion (Bragg) Group

Prepared by:

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File 448-09-01-01

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SECTION 1

INTRODUCTION

To examine the effectiveness of the remedial action on groundwater conditions, additional ground water monitoring will be conducted as part of the remedial action. The existing shallow aquifer monitoring wells will be sealed and abandoned, and replaced with ten new monitoring wells. These new wells will be tested semi-annually for at least a 30-year period with confirmatory samples to be taken during the quarter following the sampling event that revealed the presence of a parameter requiring such confirmatory sampling, unless it can be demonstrated that further monitoring is not necessary. This schedule will be subject to review after 5 years. Details of the ground water sampling are covered in this plan and in the Ground Water Sampling sections of the Sampling and Analysis Plan and the Quality Assurance Project Plan.

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SECTION 2

GROUND WATER MONITORING PLAN

2.1 Monitoring Well Replacement

The existing on-site monitoring wells at the Marion (Bragg) Landfill will be abandoned as part of implementing the selected remedy. Plugging and abandonment of on-site monitoring wells will be conducted to conform to applicable requirements of state and local authorities. The existing on-site monitoring wells will be pulled or drilled out to the elevation of the end of the original boring as indicated on the associated boring log. The borehole will be held open with drilling mud or temporary casing, as required, to prevent sloughing of cuttings into the borehole. Finally, each borehole will be sealed in a single stage by filling with grout, beginning at the bottom of the hole and progressing upward. An accurate record of well plugging and abandonment will be kept, and will include such data as: well number, grout mix, calculated borehole volume, measured volume of grout pumped into the borehole, pressure during pumping, and time necessary to complete grouting. Details of the plugging and abandonment are provided in the design package for the Marion (Bragg) Landfill Closure.

2.2 Monitoring Well Network

Locations for ten new monitoring wells to replace the abandoned wells have been proposed, based on the following considerations:

- o Wells should not be installed through buried wastes;
- o Site geology is simple, with a relatively homogeneous upper aquifer;

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- o The upper aquifer discharges into the Mississinewa River.

Indiana Solid Waste Rule 329IC 2-16 requires that downgradient monitoring wells be within 50 feet of the waste boundary, but the exact boundary has not been defined in this case. However, attempts will be made to comply with this rule.

Eight of the shallow aquifer monitoring wells (MB-1 through MB-8) will be installed at locations on the landfill property which are downgradient from areas of waste deposition, and upgradient from the Mississinewa River. These wells, close to the river and outside of the landfill wastes, will provide an indication of the quality of ground water which is discharging to the river. In addition, these wells will help to monitor the potential influence of surface water quality on the quality of ground water beneath the site, which is a common occurrence in river flood plains during extended periods of high water and gradient reversal.

The other two monitoring wells (MB-9 and MB-10) will be installed upgradient from the facility to provide background information and data regarding the quality of ground water entering the site.

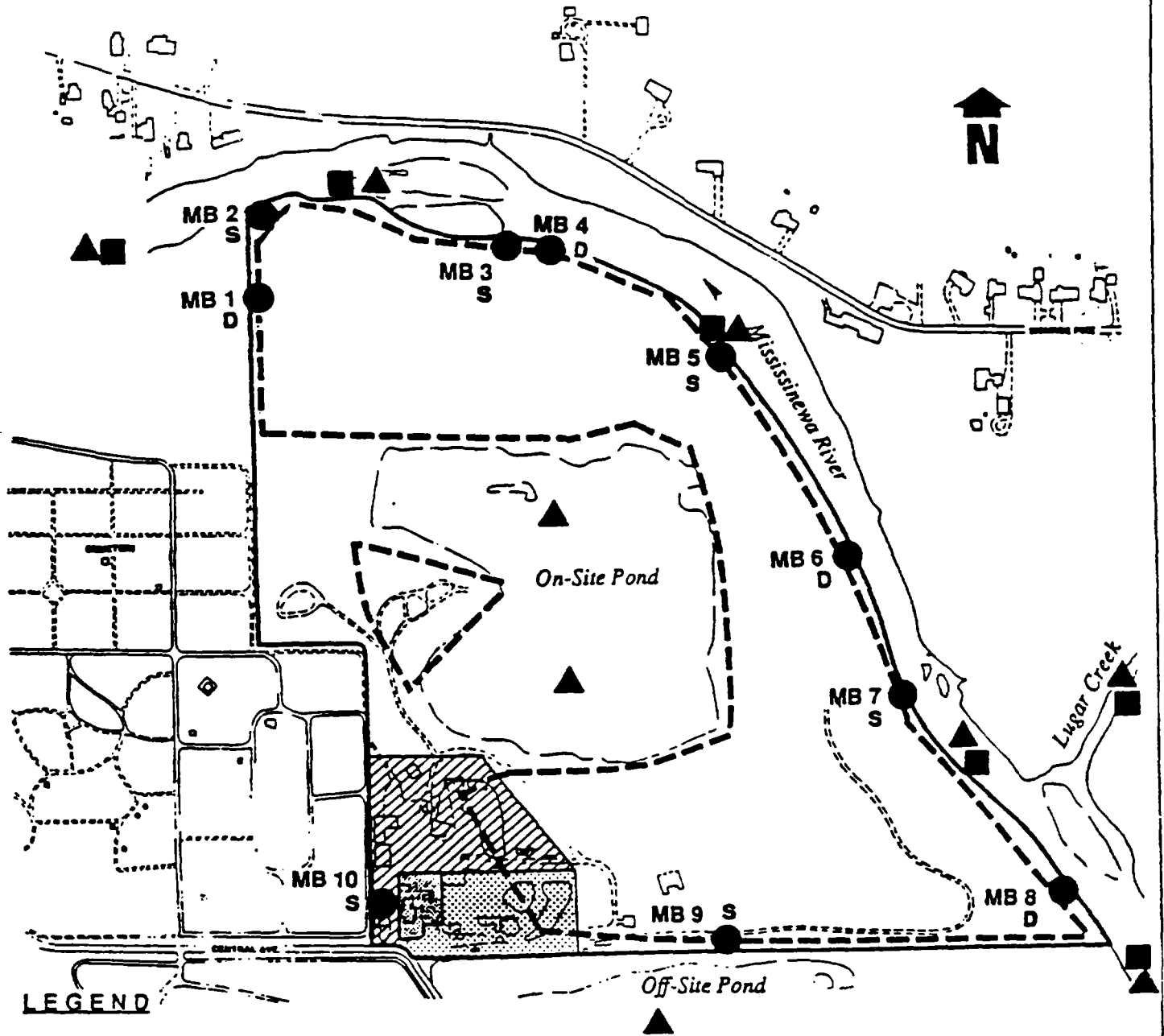
The proposed locations of the monitoring wells are shown in Figure 2-1.

2.3 Ground Water Monitoring

Ground water monitoring involves periodic measurement of water levels in the new monitoring wells and water quality monitoring.

Figure 2-1 Proposed Sampling Locations Marion (Bragg) Landfill

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LEGEND

- Site Boundary
- //// Marion Paving Co., Inc.
- ▨ Dobson Construction Co., Inc.
- Private Residence
- - - Landfill Area
- ▲ Proposed Surface Water Sampling Locations
- Proposed Ground Water Sampling Location
- S - Shallow Zone of Upper Aquifer
- D - Deeper Zone of Upper Aquifer
- Proposed Sediment Sampling Location

0 250 500
Scale in Feet

Source: U.S. EPA 1987.

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Water level measurements will be taken from each of the newly installed wells within 24 hours after well completion, and after development. Depth to water measurements will be taken on a monthly basis from the monitoring well network for a minimum of three months, and quarterly thereafter, for the remainder of the year. This schedule should allow for detection of variations in water table elevations over this time period. Following the first year of water level measurements, water level measurements will be made in conjunction with each sampling event.

Ground water samples will be obtained from each of the shallow and deep wells from the upper aquifer for analysis of the TCL/TAL Analytes (less pesticides and PCBs), and the Indiana Department of Environmental management (IDEM) indicator parameters listed in Table 2-1. Upon receipt of the first round of ground water analytical results, an evaluation of the data will be performed to establish a list of confirmatory sampling parameters for semi-annual sampling as part of the indicator parameter list for the entire event. The data evaluation will include a comparison of analytical results from the downgradient monitoring wells to appropriate standards and upgradient water quality. If the standards are exceeded, subsequent action will be taken, which will include both the averaging of results of water quality analyses for monitoring wells from each zone and the actions outlined in the decision tree for future studies. In addition, confirmatory sampling will take place during the quarter following the sampling event that revealed the presence of a parameter requiring such confirmatory sampling.

TABLE 2-1
IDEM INDICATOR PARAMETER LIST
MARION (BRAGG) LANDFILL
MARION, INDIANA

Temperature
pH
Total Suspended Solids
Specific Conductivity
COD
NH₃-N
Chlorides
Dissolved Oxygen

2.4 Monitoring Schedule

The proposed ground water monitoring schedule calls for the initial round of sampling to occur before the capping is begun. At this time, the TCL/TAL Analytes (not including pesticides and PCBs) and IDEM Indicator Parameter List analyses will be performed. Following this initial sampling event, samples will be collected and analysed for the IDEM Indicator Parameter List plus confirmatory sampling parameters determined from the first round of sampling every three months, and for the TCL/TAL Analytes every six months, for at least 30 years, with re-evaluation after five years (see Figure 2-2). Should the ground water quality remain relatively consistent over time, monitoring may not need to be as extensive and may be reduced after review by the EPA and IDEM.

FI IE 2-2
PROPOSED GROUNDWATER SAMPLING SCHEDULE

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Elapsed Time (years)	0	0.25	0.5	0.75	1.0	1.25
	Capping Started		Capping Completed		Vegetative Cover	
	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP
	1.5	1.75	2.0	2.25	2.5	2.75
	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP
	3.0	3.25	3.5	3.75	4.0	4.25
	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM	IDEM + CSP
	4.5	4.75	5.0			
	TCL + TAL IDEM	IDEM + CSP	TCL + TAL IDEM			

NOTE: Schedule shown is for a 5-year time limit. This schedule will be repeated for 30 years, but will be subject to review at the end of the 5-year period.

TCL + TAL = Target Compound List (minus pesticides and PCBs) plus Target Analyte List

IDEM = IDEM Indicator Parameter List

CSP = Confirmatory Sampling Parameters (determined after each semi-annual sampling event)

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2.5 Decision Tree for Future Studies

The ground water monitoring and additional studies outlined in the RAP and the Sampling and Analysis Plan are intended to complete the investigation of the on-site pond and ground water operable units, as specified in the EPA and IDEM Record of Decision. The results of ground water monitoring will be evaluated along with other sampling and analysis data to determine the effectiveness of the remedy and the need for any future studies. The decision methodology for these future studies is discussed in the RAP and the Sampling and Analysis Plan.